AMERICAN MACHINIST

March 8, 1939

ONLY TOOLING—***Next week tool engineers will break away from their boards to attend the A.S.T.E. meeting at Detroit (page 114a)***

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McGraw-Hill Publishing Company, Inc.

Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y. Branch offices: Chicago, 520 North Michigan Ave.; San Francisco, 833 Mission Street; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

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VOLUME 83 — NUMBER 5

AMERICAN MACHINIST. Copyright, 1939 by McGraw-Hill Publishing Co., Inc.

Published every other Wednesday, price 35c a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3.00 a year. All other countries (except Europe and British possessions in Eastern Hemisphere), $6.00 a year or 24 shillings. Entered as second class matter, September 29, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Cable address: "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

A McGRAW-HILL PUBLICATION

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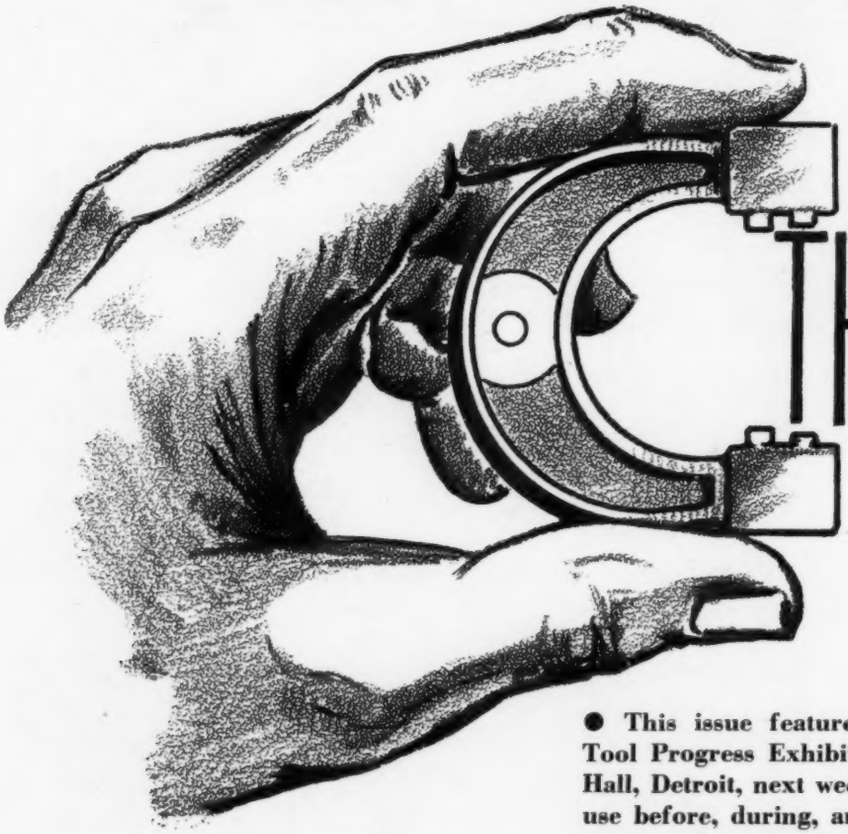
Tool Engineers
It's Gaged To Your Need



THIS ISSUE

● **This issue features the Second Annual Machine & Tool Progress Exhibition, to be held in the Convention Hall, Detroit, next week, March 14–18. It is designed for use before, during, and after the Show. Whether or not you attend, you will find this issue gaged to your need.**

For maximum usefulness, the editors have included a complete list of exhibitors, a program of the meetings, a special section on Cutting Materials, several special articles on tooling—plus the usual departments and well-balanced editorial content that make American Machinist so widely read.

If you are going to the Show, use this as a guide to conserve your time. Read the advertisements to get details of equipment to be exhibited, as well as of other metal-working equipment to help you do your job better. Here is your permanent record of the Show, whether or not you can attend.

You are invited to visit American Machinist at Booth A-98

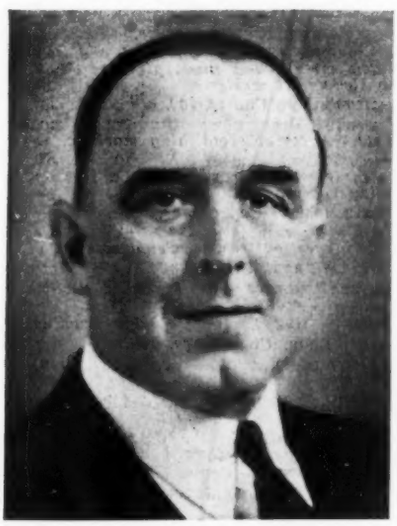
★

AMERICAN MACHINIST

Giving you the best in Metal-Working Practice

A.S.T.E. Meeting and Show To Feature Modern Equipment

Evening sessions will be devoted to discussions of surface finishing problems and new equipment, materials and methods . . . Preview dinner to be held



Walter F. Wagner, president of A.S.T.E. during 1938, is master mechanic at the Lincoln Motor Car Company's plant. During his year in office the society has continued to add new members and chapters

A SYMPOSIUM on surface finishing, with papers on grinding, honing, lapping, diamond boring, superfinishing and the measurement of surface finishes, will be one of the highlights of the Second Annual Meeting of the American Society of Tool Engineers. A second symposium will include papers discussing new developments and their effect on the activities of the tool engineer. Scheduled to be held at Detroit's Convention Hall March 14 to 18 inclusive, this meeting will run simultaneously with the Second Machine and Tool Progress Exhibition. The two technical sessions have been scheduled for Wednesday and Friday evenings, leaving visiting engineers and industrial supervisors free to spend the daylight hours visiting the exhibition or taking advantage of the plant inspection tours that have been arranged for convention week. Special arrangements have been made to take groups through plants of the Cadillac Motors Company, Chrysler Motor Company, DeSoto Motor Company, Dodge Motor Company, Dodge Truck Company, Hudson Motor Company, Packard Motor Company, Plymouth Motor Company, Rotary Electric Steel Company, Timken-Detroit Axle Company, U. S. Rubber Company and about two dozen smaller plants.

Of national significance is the spe cial "preview" dinner on Monday evening, prior to the opening of the show. Sponsored by a group of industrial leaders, including K. T. Keller, president, Chrysler Corporation; W. S. Knudsen, president, General Motors Corporation, Alvan Macauley, president, Packard Motor Company, and Edsel Ford, president, Ford Motor Company, the dinner will be attended by a specially invited group of industrialists, educators, editors, ministers and legislators.

A speaker at the dinner will be H. G. Moulton, president, The Brookings Institution; toastmaster will be L. Clayton Hill, manufacturing manager, Murray Corporation. At the dinner will be discussed the initial findings of the A. S. T. E. Fact Finding Committee which, under the direction of Professor John M. Younger, Ohio State University, has undertaken an investigation of the effect of the machine on employment and the nation's standard of living. This committee is composed of such men as Professor Younger, chairman; James R. Weaver, Westinghouse Electric and Manufacturing Company; John J. Caton, Chrysler

Speaker at the preview dinner scheduled for Monday evening, March 13, will be H. G. Moulton, president of The Brookings Institution and well known economist. The society's fact finding committee will report

Institute of Technology; Professor O. W. Boston, University of Michigan; Professor Carl Horack of California; E. W. Dickett, Sundstrand Machine and Tool Company; Ford R. Lamb and L. Clayton Hill.

General opening of the convention will be Tuesday morning, March 14, with registration at Convention Hall. The opening day is set aside for visiting plants and exhibits, followed by the surface finish session in the evening. The exhibition will close early on Thursday evening, to allow time for the annual dinner, to be held at the Book-Cadillac Hotel. William B. Stout, president of the Stout Engineering Laboratories and builder of the first all-metal airplane, will be the principal speaker at this dinner.

Exhibitors At The Second Machine and Tool Progress Show

Detroit Convention Hall, March 14-18, 1939

(Booth number follows name of company)

ABRASIVE CO., *(A-19). Grinding wheels.*

ABRASIVE DRESSING TOOLS CO., *(A-1). Diamond wheel dressing tools.*

ALLEN MFG. CO., *(B-68). Socket-head cap screws, shoulder screws and set screws, wrench sets.*

ALLIS-CHALMERS MFG. CO., *(A-69). Motors and control equipment.*

AMERICAN BROACH SALES CO., *(C-14). Broaching tools and broached parts. 5-hp. hydraulic transmission.*

AMERICAN CHAIN & CABLE CO., *(A-73). "Speedway" electric hoists.*

AMERICAN CUTTING ALLOYS, INC., *(C-42). Carbide-tipped tools.*

AMERICAN EQUIPMENT CO., *(A-4).*

AMERICAN MACHINIST, *(A-98).*

AMERICAN OPTICAL CO., *(B-100). Eye protective devices.*

AMERICAN SAW & MFG. CO., *(B-10). Power hacksaw, saw blades.*

AMERICAN SOCIETY OF TOOL ENGINEERS, *(A-43).*

AMERICAN SWISS FILE & TOOL CO., *(B-100). Swiss pattern files.*

APEX MACHINE & TOOL CO., *(A-58). Chucks and toolholders, nut setters.*

ATLAS PRESS CO., *(A-16). Bench lathes, bench shaper, drill presses, arbor presses, grinders, drill grinding attachment.*

AUTOMOTIVE MAINTENANCE MACHINERY CO., *(B-24). Bench and portable shapers, tension indicator.*

BARBER COLMAN CO., *(A-39). Small tools, cutters, hobs, reamers.*

W. O. BARNES CO., *(A-85). Metal cutting band saws.*

BARRETT-CRAVENS CO., *(B-55). Lift trucks, scale trucks, skids and portable elevators.*

JOHN BATH & CO., INC., *(A-3). Gages, precision tools.*

BAUSCH & LOMB OPTICAL CO., *(B-74). Optical instruments.*

BLACK & DECKER MFG. CO., *(C-41). Portable electric drills, screw drivers, nut runners, saws, shears, grinders, sanders and accessories.*

BLANK & BUXTON MACHINERY CO., *(C-16). "Index" vertical miller.*

BOYAR-SCHULTZ CORP., *(C-82). Profile grinder, expansion laps, shop bolts.*

BOYER-CAMPBELL CO., *(B-100). "Sabeco" bronze seals, face shields.*

BRIDGEPORT MACHINES, INC., *(A-77). Vertical miller.*

BRISTOL CO., *(A-18). Socket screw products, belt lacing and belt plates.*

BROWN & SHARPE MFG. CO., *(A-6). Precision machinist's tools, magnetic chucks, pumps.*

CHARLES BRUNING CO., *(A-38). Drafting machine, black and white process printing machine.*

CAMPBELL DIV., ANDREW C., *(B-8). Abrasive cut-off machines, nibblers.*

CARBOLOY CO., INC., *(B-43). Carboloy-tipped tools, gages and wear strips.*

CARBORUNDUM CO., *(A-2). Grinding wheels.*

CHARRON ENGINEERING SALES, *(B-9).*

CHICAGO RIVET & MACHINE CO., *(A-99). Automatic rivet setters.*

CHISHOLM-MOORE MFG. CO., *(B-100). Hoists, hoist trolleys, sling chains.*

CHRYSLER CORP., *(A-12). Superfinishing equipment, superfinished parts.*

CIRCULAR TOOL CORP., *(A-91). Reamers, combination center drills, circular saws.*

COGSDILL TWIST DRILL CO., *(B-53). Drills and reamers.*

COLONIAL BROACH CO., *(A-42). Broaches and broached parts.*

COLONIAL BUSHINGS, INC., *(A-42). Drill bushings.*

CRAFTS CO., INC., ARTHUR A., *(C-10). Carbide-tipped gages.*

CUSHMAN CHUCK CO., *(B-52). Standard and special chucks.*

DALRAE TOOLS CO., *(B-3). Milling, drilling and boring heads.*

DAVIS BORING TOOL CO., DIV. LARKIN PACKER CO., *(A-100). Boring tools.*

DAYTON ROGERS MFG CO., *(A-26). Pneumatic die cushions.*

DELTA MFG. CO., *(B-34). Drilling, grinding and sawing machines, tapping attachments.*

DESANNO & SON, A. P., *(A-78). Portable grinder, abrasive cut-off machines, grinding wheels.*

DETROIT BROACH CO., *(B-60). Broaches and broached parts.*

DETROIT POWER SCREWDRIVER CO., *(C-89). Power screwdrivers.*

DETROIT TAP & TOOL CO., *(A-42). Taps, gages, precision ground threaded parts.*

DIETZEN CO., EUGENE, *(B-7). Drafting instruments, blueprint papers.*

DUMORE CO., *(B-72). Grinder heads.*

EAST SHORE MACHINE PRODUCTS CO., *(B-16). Expansion broaches, gear pump.*

ECLIPSE COUNTERBORE CO., *(A-80). Cutters and toolholders, boring tools.*

You are invited to visit the *American Machinist* Booth

A-98

while at this exhibition

ELECTRO LIFT, INC., *(B-9). Electric hoists.*

ELECTRO-MATIC PRODUCTS CO., *(B-21). Magnetic chucks.*

ESCO ENGINEERING & SALES, *(A-21).*

ETTCO TOOL CO., *(A-92). Drill heads, tappers, drill chucks.*

EXACT WEIGHT SCALE CO., *(C-38-B). Weighing devices.*

EX-CELL-O CORP., *(A-32). Bushings, broaches, counterbores, form tools, milling cutters.*

FAUVER, INC., J. N., *(C-34).*

FEDERAL MOGUL CORP., *(C-71).*

FEDERAL PRODUCTS CORP., *(A-9). Precision gages, dial indicators.*

FELLOWS GEAR SHAPER CO., *(A-31).*

FIRTH-STERLING STEEL CO., *(A-95). Firthite-tipped tools, dies and parts, brazing furnace.*

FORD MOTOR CO., JOHANSSON DIV., *(A-23). Precision gage blocks and accessories.*

FREDERICKSEN CO., *(B-100). "Sabeco" seals.*

GAIRING TOOL CO., *(B-44). Milling cutters, counterbores, drills, tool holders.*

GALLAND-HENNING MFG. CO., *(C-72). Pneumatic cylinders.*

GAMMONS-HOLMAN CO., *(B-16). Reamers and end mills.*

GEORGE, JAMES W., *(A-41).*

GILMER CO., L. H., *(B-100). Belting.*

GLENZER CO., J. C., *(C-15).*

GODDARD & GODDARD, INC., *(A-86). Milling cutters, reamers, boring, facing and chamfering tools.*

GOODSPEED-DETROIT CO., *(B-16). Broaches, pumps, reamers, end mills, speed lathe, arc welder, reamer grinder, polishing machine, variable speed drive, expansion mandrels, wheel dressers, flexible hose.*

GORHAM TOOL CO., *(A-36). Cast high speed steel, milling cutters, slitting saws, end mills, form tools, wear-resisting alloy centers and bushings.*

GOVRO-NELSON CO., *(B-53). Drilling heads.*

GREENFIELD TAP & DIE CORP., *(A-34). Taps, dies, drills, reamers, gages, pipe tools, screw extractors, and screw plates.*

GRINDING MACHINERY CO., *(B-21). Coolant pumps, dust collectors, layout plates, demagnetizers, grinders, gages.*

GROB BROS., *(B-54). Open-end and continuous metal band saws, filing machine, saw blade butt welder.*

HAMILTON MFG CO., *(A-56).*

HAMMOND MACHINERY BUILDERS, INC., *(C-91). Automatic polishing machine.*

HANNA ENGINEERING WORKS, *(B-9). Squeeze riveters, pneumatic cylinders, operating valves.*

HANNIFIN MFG. CO., *(A-33).*

HANSON-WHITNEY CO., *(C-59). Taps, thread gages, cutters, precision screws.*

HARDINGE BROS., INC., *(C-86).*

HAYNES STELLITE CO., *(B-26). Stellite 2400 and J-metal tools, wear strips.*

HEIM CO., *(B-16). Die polishing machine.*

HELLER BROS. CO., *(B-73). Files.*

HOLE ENGINEERING SERVICE, *(B-53). Drilling units.*

HOLO-KROME SCREW CORP., *(A-63). Socket screw products, wrench sets.*

HOUGHTON & CO., E. F., *(C-61). Cutting oils and bases, lubricants, belting.*

HOVIS SCREWLOCK CORP., *(B-19).*

HOWELL ELECTRIC MOTORS CO., *(C-83). Electric motors.*

HUOT MFG. CO., *(B-75). Drill indexes.*

ILLINOIS TESTING LABORATORIES, INC., *(B-25). Temperature measuring and controlling instruments.*

ILLINOIS TOOL WORKS, *(B-36). Milling cutters, hobs, broaches and special tools.*

INDEPENDENT PNEUMATIC TOOL CO., *(C-33). Portable electric tools.*

INGERSOLL MILLING MACHINE CO., *(A-8). Milling cutters.*

INTERNATIONAL NICKEL CO., INC., *(C-65). Parts made from nickel-alloyed materials.*

JACOBS MFG. CO., *(A-65). Standard and single-purpose chucks.*

JARVIS CO., CHARLES L., *(A-48). Flexible shaft machines and attachments, rotary tools, tapping attachments.*

JOHNSON BRONZE CO., *(C-8). Bearing metals.*

JONES-FORS CO., *(A-57). Portable drills and grinders, drill and lathe chucks.*

JONES & LAMSON MACHINE CO., *(A-50).*

KOEBEL DIAMOND TOOL CO., *(A-53).*

LEE MACHINERY CO., *(A-28). Lathes.*

LEE & SON CO., K. O., *(B-16). Arc welder, cutter grinder, drill chucks, expanding mandrels.*

LELAND-GIFFORD CO., *(B-70).*

LEMAIRE TOOL & MFG. CO., *(A-25) Drilling units, gear chucks, drilling machines.*

LENNEY MACHINE & MFG. CO., *(B-16). Variable speed transmission.*

LINK ENGINEERING & MFG. CO., *(A-17). Spring checking devices.*

LOGANSPORT MACHINE, INC., *(A-4). Chucks, collets, pumps.*

LUFKIN RULE CO., *(A-74). Precision tools.*

MCCASKEY REGISTER CO., *(B-80).*

MCCROSKY TOOL CORP., *(A-45-A). Milling*

cutters, reamers, boring tools, chucks, collets, tool posts.

MACKLIN CO., *(B-5). Grinding wheels.*

MANUFACTURERS BRUSH CO., *(B-100).*

MANUFACTURERS SALES CO., *(C-88-90). Grinders, tappers, screwdrivers, trucks.*

MARBURG BROS., *(C-7).*

MARTINDALE ELECTRIC CO., *(B-15). Flexible shaft units, rotary tools, burrs.*

M-B PRODUCTS, *(A-8½). Diamond tools.*

MICHIGAN TOOL CO., *(A-42). Gear finishers, cutting tools.*

MICROMATIC HONE CO., *(C-96). Hones and honing fixtures.*

MID-WEST PRODUCTION ENGINEERING CO., *(A-10). Punching units.*

MIDWEST TOOL & MFG. CO., *(A-45-B). Milling cutters, reamers, counterbores, form tools, adjustable tool holders.*

MINSTER MACHINE CO., *(B-31). Presses.*

MODERN COLLET & MACHINE CO., *(B-58). Collets, feed fingers, cams, spindles.*

MORRISON MACHINE PRODUCTS DIV., *(C-85).*

MORSE TOOL CO., *(A-51). Milling cutters, form tools, reamers, counterbores, core drills and spotfacers.*

MOTOR TOOL MFG. CO., *(C-11). Drill chucks.*

MUELLER BRASS CO., *(C-18). Bearing metals.*

NATIONAL AUTOMATIC TOOL CO., *(A-35).*

NATIONAL BROACH & MACHINE CO., *(A-49).*

NATIONAL TOOL SALVAGE CO., *(A-82).*

PRODUCTO MACHINE CO., *(C-36-A). Die sets.*

PROGRESSIVE WELDER CO., *(C-30).*

PUTNAM TOOL CO., *(B-66). End mills, counterbores, reamers and special tools.*

PYRO-ELECTRO INSTRUMENT CO., *(A-87). Hardness testers.*

Q-C ENGINEERING PRODUCTS, *(A-5). Jigs and fig parts, production tools.*

RACINE TOOL & MACHINE CO., *(B-56). Coolant pumps.*

RASMUSSEN MACHINE CO., *(B-10). Power hack saw.*

RAYL CO., *(A-67).*

READY TOOL CO., *(A-90).*

REEVES PULLEY CO., *(C-94). Variable speed transmissions.*

ROSS OPERATING VALVE CO., *(A-89). Control valves.*

ROTOR TOOL CO., *(B-50). High cycle portable drills, screwdrivers and nut setters.*

SCHAUER MACHINE CO., *(B-16). Speed lathes.*

SCHERR CO., GEORGE, *(C-57). Precision instruments.*

SCHRADER'S SON DIV., A., *(C-67). Spray guns, fittings, valves.*

SCULLY-JONES & CO., *(C-63). Reamers, counterbores, drill and tap drivers.*

SEAMLEX CO., *(B-16). Flexible metal hose.*

SEVERANCE TOOL MFG. CO., *(A-88). Chamfering tools.*

SHAKEPROOF LOCKWASHER CO., *(B-36).*

SUPER TOOL CO., *(A-22). Carbide-tipped tools.*

SUTTON TOOL CO., *(A-45-C). Screw machine tools and collets.*

SWARTZ TOOL PRODUCTS CO., INC., *(A-14). Fixtures and fixture locks.*

SWEDISH GAGE CO. OF AMERICA, *(A-24). Precision gages.*

TAFT-PEIRCE MFG. CO., *(C-100). Surface grinder, tools and gages.*

TANNEWITZ WORKS, *(B-10). Metal cutting band saws.*

T C M MFG. CO., *(C-36-B). Grinding and lapping machine*

TEXAS CO., *(C-37-A).*

THOMAS MACHINE MFG. CO., *(A-20). Presses.*

TOMKINS-JOHNSON CO., *(B-33).*

TOWMOTOR CO., *(C-92). Industrial trucks.*

TUNGSTEN CARBIDE TOOL CO., *(A-42). Carbide-tipped tools.*

UNITED STATES ELECTRICAL TOOL CO., *(A-71). Electric drills and grinders.*

UNIVERSAL HIGH SPEED TOOL CO., *(B-23). Milling, drilling and boring heads.*

VANADIUM-ALLOYS STEEL CO., *(B-51).*

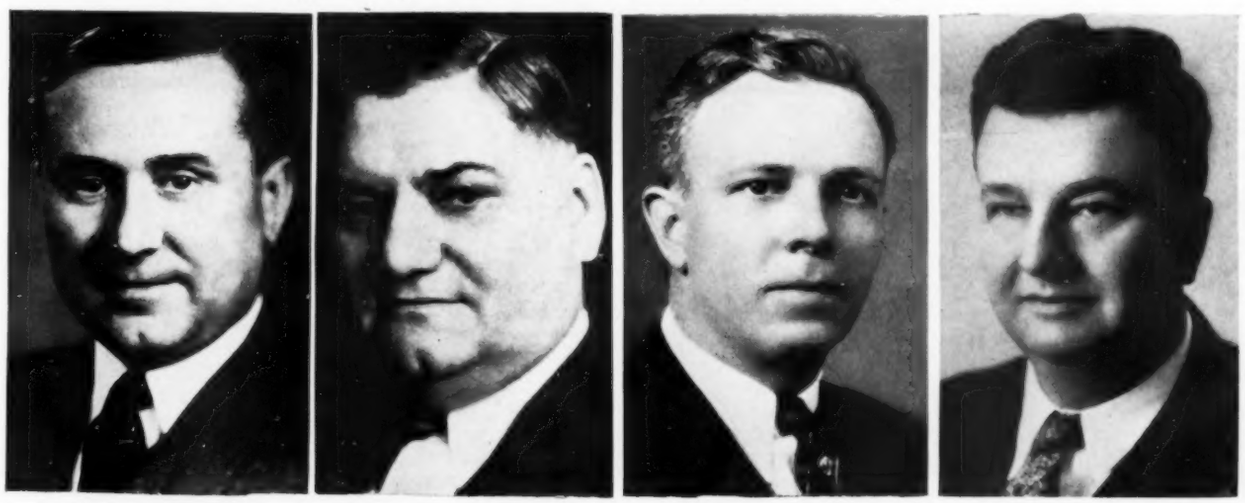
VAN DORN ELECTRIC TOOL CO., *(C-41). Portable electric tools.*

VICKERS, INC., *(A-11).*

VICTOR SAW WORKS, INC., *(B-100). Hack saw blades.*

VINCO TOOL CO., *(C-1).*

Officers of the American Society of Tool Engineers



JAMES R. WEAVER FRANK A. SHULER FORD R. LAMB GEORGE A. SMART

James R. Weaver, Westinghouse Electric and Manufacturing Company, is first vice-president and will open the general discussion during the symposium on mechanical surface finishing. Master mechanic at Chrysler's Highland Park plant, Frank A. Shuler is general chairman of the 1939 show committee. Ford R. Lamb, executive secretary of the society, has been doubling as show manager. George A. Smart is tool supervisor at the Acme Machinery Company's plant and has been serving as second vice-president of the society for the past year

NEW BRITAIN MACHINE CO., *(A-76). Collets.*

NIELSEN, INC., *(B-16). Live centers.*

NICHOLSON FILE CO., *(A-66). Files.*

NORTON CO., *(A-47). Grinding wheels.*

O. K. TOOL CO., *(B-48). Milling cutters and tool holders.*

OZALID CORP., *(B-28). White print machines.*

PARAGON-REVOLUTE CORP., *(B-12).*

PARKER KALON CORP., *(C-80).*

PEASE CO., C. F., *(A-46). Blueprinting machines.*

PFEIL, INC., GEORGE H., *(C-37-B).*

PHYSICISTS RESEARCH CO., *(A-59). Profilometer.*

PIONEER ENGINEERING & MFG. CO., *(C-78). Coolant pumps.*

POSITIVE SAFETY MFG. CO., *(B-100). Press safety devices.*

PRATT & WHITNEY DIV., *(A-37). Small tools and precision gages.*

PREIS ENGRAVING MACHINE CO., H. P., *(C-39). Universal milling, copying and engraving machines.*

SHEFFIELD GAGE CORP., *(B-1). Precision gages.*

SINGER SEWING MACHINE CO., *(A-40). Industrial sewing machines.*

SKINNER CHUCK CO., *(B-100). Lathe chucks.*

SMITH, ROY, *(C-98). Hobart arc welders.*

SNYDER TOOL & ENG. CO., *(B-46).*

SOCONY VACUUM OIL CO., INC., *(B-49).*

STANDARD GAGE CO., *(A-52).*

STANDARD SHOP EQUIPMENT CO., *(A-29).*

STANLEY ELECTRIC TOOL DIV., *(B-18). Contour grinder, portable electric tools.*

STARRETT CO., L. S., *(A-64). Small tools and precision gages.*

STOKER-UNIT CORP., *(A-81). Precision boring and lapping machines.*

STRAND & CO., N. A., *(B-100). Flexible shaft machines and attachments.*

STRELINGER CO., CHARLES A., *(C-74).*

STRONG, CARLISLE & HAMMOND CO., *(A-83).*

STUART OIL CO., D. A., *(A-97). Grinding and cutting compounds.*

SUNNEN PRODUCTS CO., *(B-53).*

VINE MACHINERY, R. A., *(A-27).*

WALKER-TURNER CO., INC., *(C-54).*

WELDING EQUIPMENT SUPPLY CO., *(C-42).*

WELDON TOOL CO., *(A-61).*

WESSON CO., *(B-14). Tool grinders.*

WESTINGHOUSE ELECTRIC & MFG. CO., *(A-44). Welding sets, motors, control equipment, lighting fixtures.*

WESTLOF TOOL & DIE CO., *(C-38-A). Machine tool drive unit.*

WETMORE REAMER CO., *(A-93). Adjustable and solid reamers, boring bars, special tools.*

WHITNEY METAL TOOL CO., *(B-6).*

WILLIMAS & CO., J. H., *(B-64). Wrenches and tool holders.*

WILSON MECHANICAL INSTRUMENT CO., *(B-30). Hardness testers.*

YALE & TOWNE MFG. CO., *(C-31). Trucks and hoists.*

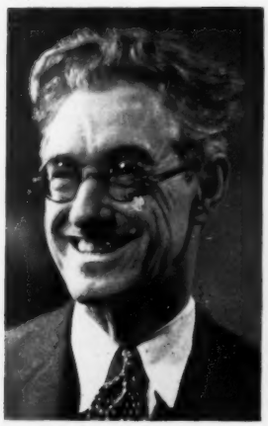
ZAGORA MACHINE & GEAR CO., J., *(C4).*

ZEISS, INC., CARL, *(C-99). Precision measuring instruments.*

ZIEGLER TOOL CO., WM. M., *(C-1).*

Speakers at A.S.T.E. Meeting

Ray Russell Photo



WILLIAM B. STOUT

D. A. WALLACE

IRA J. SNADER

F. T. ELLIS

H. J. GRIFFING

CARL J. OXFORD

Principal speaker at the annual dinner will be William B. Stout, president, Stout Engineering Laboratories. D. A. Wallace, president, Chrysler Sales Corporation, Ira J. Snader, chief engineer, Ex-Cell-O Corporation, F. T. Ellis, Heald Machine Company, H. J. Griffing, Norton Company, and Carl J. Oxford, chief engineer, National Twist Drill Company, will be among the speakers taking part in the symposium on mechanical surface finishing

Meeting and Exhibition Program

TUESDAY, MARCH 14

9:00 a.m. to 6:00 p.m.
Machine and Tool Progress Exhibition . . . Convention Hall
Registration of members and visitors . . . Convention Hall
Registration for plant inspection tours . . . Convention Hall

9:30 a.m.
Plant Inspection Tours

1:30 p.m.
Plant Inspection Tours

WEDNESDAY, MARCH 15

9:00 a.m. to 10:00 p.m.
Machine and Tool Progress Exhibition . . . Convention Hall

9:30 a.m.
Plant Inspection Tours

1:30 p.m.
Plant Inspection Tours

8:00 p.m.
Technical Session . . . Convention Hall Annex
Subject—"A Symposium On Mechanical Surface Finishing"
Chairman—C. J. Oxford, chief engineer, National Twist Drill Co.
Introduction and general discussion—J. R. Weaver, director of equipment, purchases, tests and inspection, Westinghouse Electric and Manufacturing Company
Grinding—Ira J. Snader, chief engineer, Ex-Cell-O Corporation
Honing—Kirke W. Connor, president, Micrometric Hone Co.
Lapping—H. J. Griffing, research engineer, Norton Company
Diamond Boring and Finishing—F. T. Ellis, Heald Machine Co.
Superfinishing—D. A. Wallace, president, Chrysler Sales Corporation
Measurements of Surface Finish—Dr. Ernest Abbott, president, Physicists Research Company

THURSDAY, MARCH 16

9:00 a.m. to 6:00 p.m.
Machine and Tool Progress Exhibition . . . Convention Hall

9:30 a.m.
Plant Inspection Tours

10:00 a.m.
Meeting of Board of Directors—Fort Shelby Hotel

1:30 p.m.
Plant Inspection Tours

6:30 p.m.
Annual Dinner . . . Book-Cadillac Hotel
Report of National Officers
Installation of New National Officers
Address—William B. Stout, president, Stout Engineering Laboratories
Subject—"The Tool Engineer's Contribution to Civilization"

FRIDAY, MARCH 17

9:00 a.m. to 10:00 p.m.
Machine and Tool Progress Exhibition . . . Convention Hall

9:30 a.m.
Plant Inspection Tours

10:00 a.m.
Meeting of Standards Committee—Fort Shelby Hotel

1:30 p.m.
Plant Inspection Tours

8:00 p.m.
Technical Session . . . Convention Hall Annex
Subject—"New Developments and Their Effect on the Tool Engineer"
Chairman—Chris Borneman, supervisor, Tool and Gage Department, General Electric Company
Hydraulic Units—K. R. Herman, vice-president, Vickers, Inc.
Gages—C. Johnson, Pratt & Whitney Division, Niles-Bement-Pond Company
Cutting Tools—L. C. Gorham, president, Gorham Tool Company
Gear Tooth Finishing—R. Drummond, National Broach and Machine Company
Effect of Lapping or Honing of Cutting Edges of Tools—John Lindegren, Crompton and Knowles Loom Works

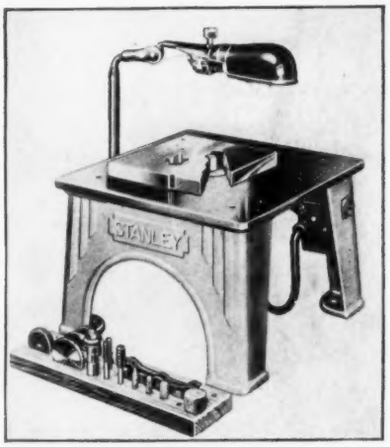
SATURDAY, MARCH 18

9:00 a.m. to 6:00 p.m.
Machine and Tool Progress Exhibition . . . Convention Hall

9:30 a.m.
Tour of Greenfield Village

SHOW IN PRINT

NEW AND IMPROVED MACHINES, TOOLS AND ACCESSORIES ON DISPLAY AT THE A.S.T.E. MACHINE AND TOOL PROGRESS EXHIBITION IN DETROIT, MARCH 14-18



The No. 150 Stanley grinder has a high-speed vertical spindle

A grinder is mounted in the case of this Grob saw blade welder

There are three standard sizes of the Lee a.c. arc welder

No. 150 Contour Grinder Operates at 18,000 R.P.M.

Developed for finishing dies, gages, templets and special shapes, this No. 150 tool and die-makers contour grinder, announced by the Stanley Electric Tool Div., Stanley Works, New Britain, Conn., is equipped with a $\frac{3}{8}$ hp. universal motor which operates at 18,000 r.p.m. Work-table measures 12x12 in. and is provided with an adjustable light fixture. The motor is held directly under the work table in a holder that is adjustable from 90 to 45 deg. The mounted point, grinding wheel or rotary file projects through an opening in the table top. Motor unit can be removed from the holder and used with special accessories for tool post lathe grinding.

Type BW Butt Welder Has Improved Clamps

Developed for butt welding saw blades from $\frac{1}{16}$ to $\frac{1}{2}$ in. wide, the Type BW welder announced by Grob Bros., Grafton, Wis., is of improved design to permit positive and accurate alignment of the saw blade and full electrical contact. The saw guides are adjusted so that the teeth of the blade are outside the clamp. These clamps are provided with an eccentric connected with a small lever, and they automatically adjust themselves to various thicknesses of saw blades. The welding operation is entirely automatic and can be performed rapidly. After the blade has been welded and annealed, it is removed from the clamps ready for grinding. Over-all dimensions of the welder are: height, 12 in.; width, 8 in.; depth, $8\frac{1}{4}$ in. Net weight is 58 lb.

A.C. Arc Welder Has Ten Control Taps

Ten stages of current control are incorporated in a panel at the side of this a.c. arc welder developed by K. O. Lee & Son Co., Aberdeen, S. D. Model W 150 has a range from 20–150 amp. on 220 volts, 60 cycle supply. It is particularly suitable for sheet metal work that does not require electrodes larger than $\frac{5}{32}$ in. The medium size Model W 200 welder has capacity ranging from 20–200 amp. and will handle $\frac{1}{16}$ to $\frac{3}{16}$ in. electrodes with a maximum current consumption of 6 kw. per hr. The largest unit, Model W 250, is rated at 20–250 amp. and will use electrodes ranging from $\frac{1}{16}$ to $\frac{1}{4}$ in. in diameter, consuming a maximum of 7.5 kw. per hr. All three models are 33 in. high without casters and measure 18 in. in diameter.

Thread Lead Tester Uses Reed Mechanism

Incorporating the frictionless reed mechanism used in other Sheffield gages, the thread lead testing machine announced by the Sheffield Gage Corp., Dayton, Ohio, compares the lead interval of screw and worm threads against a precision or master block setting. The Model No. 30 instrument will take 10 in. between centers, and 5 in. of thread up to 6 in. in diameter. The standard No. 40 model, and other special models, are available for longer screws.

The visual gage head, having a frictionless reed pivot with the "Sheffield" reed mechanism is supported on a bracket by four horizontal metal reeds to allow the contact point to be lowered into and raised out of the screw thread being tested. This short vertical clearance travel is secured through a convenient hand knob. Vertical positioning to accommodate any diameter screw within the capacity of the instrument is controlled by a hand knob operating a vertical screw and nut.

Hardness Testers Have Motor-Driven Heads

Motor drive of the Model 3-CR "Rockwell" hardness tester offered by Wilson Mechanical Instrument Co., Inc., 383 Concord Ave., New York, N. Y., provides semi-automatic operation. Designed for internal testing of large tubes and cylinders, this unit is made with an 8-in. vertical capacity, 6-in. horizontal reach, and will test internal surfaces down to 4 in. inside diameter. Correct application of both minor and major loads is said to be insured through a frictionless, free-floating plunger system and mathematically correct loads and leverages. Standard readings are obtained. A similar Model 3-CS "Rockwell" superficial hardness tester also has been announced.

Developed for application where hardness testing requirements call for 100 per cent production testing of parts made in large quantities, or for testing a large percentage of the product, the Model QR "Rockwell" hardness testers are motor operated and produce readings identical with readings obtained on hand-operated "Rockwell" machines. Speed of op-

eration has been increased to a point consistent with accurate and reliable results. This model has an 8-in. vertical capacity. The Model QS superficial hardness tester is similar in design and operation.

No. 4 Inclinable Press Has 14-Point Clutch

Featuring an improved frame design and a 14-point engagement spline clutch, the No. 4 open-back inclinable press announced by the Minster Machine Co., 52 W. Fifth St., Minster, Ohio, has a Timken roller bearing mounting for the clutch wheel. Slide and gib construction of this machine has been improved. Provision is made for pressure lubrication of all bearing surfaces.

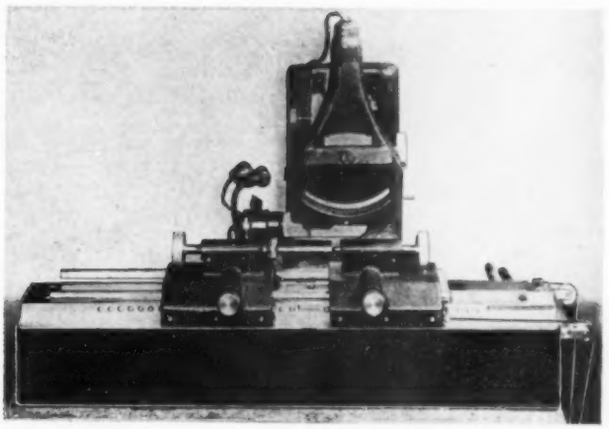
"Ammco" Portable Shaper Has 6-In. Capacity

The improved portable "Ammco" 6-in. precision shaper developed by the Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., North Chicago, Ill., is mounted on a standard wood cabinet. Large casters and a handle provide for moving the shaper to the mechanic's workbench.

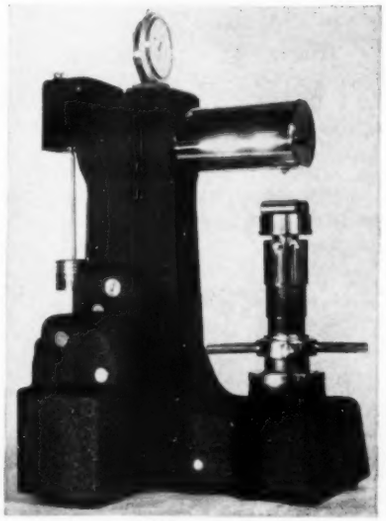
Specifications: maximum stroke, 7 in.; length of ram, 17 in.; speeds, 70-110-150 strokes per min.; horizontal travel of table, $9\frac{1}{2}$ in.; vertical travel of table, $5\frac{3}{8}$ in.; reversible cross feeds, 0.003–0.015 in. in five steps; width of vise jaws, $3\frac{7}{8}$ in.; net weight, not including motor, 185 lb.; motor recommended, $\frac{1}{4}$ hp. When mounted on the cabinet, the over-all length is 36 in., width is 24 in., and height is 56 in.

Four Gaging Units Announced by Federal

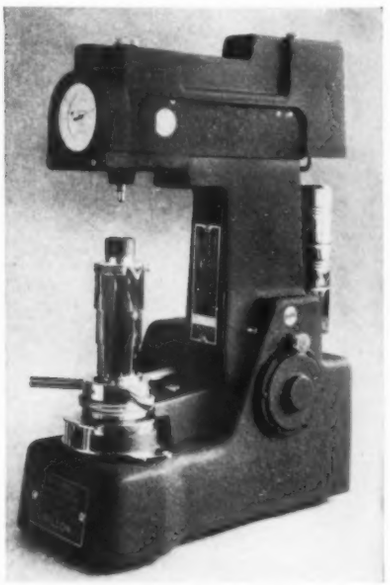
The Federal Products Corp., 1144 Eddy St., Providence, R. I., has announced the addition of four gaging units to its extensive line of measuring instruments. The Model 110B-3 "Super Sensitive" comparator, shown in Fig. 1, features a contact point spindle supported by a spring bellows which is claimed to eliminate friction on the spindle. The lever at the side of the indicator is for fine adjustment of the contact point, after the indicator has been brought to approximate position on the vertical slide and clamped. The indicator on this unit s graduated to 0.0001 in. and has a range of 0.003



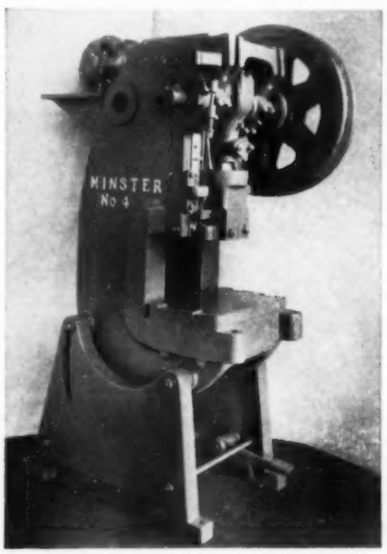
Thread lead errors are magnified 2,000 times in this gaging unit announced by Sheffield



Model 3-CR hardness testers have been used for checking nitrided engine cylinders



Readings on the Model QR "Rockwell" tester are independent of the thickness of the part



The No. 4 Minster inclinable press incorporates a number of improved features

The "Ammco" 6-in. shaper now is available in a portable model

Fig. 1—This Model 110B-3 comparator has a maximum capacity of 4.488 in. from the top of the anvil clamp to the contact point

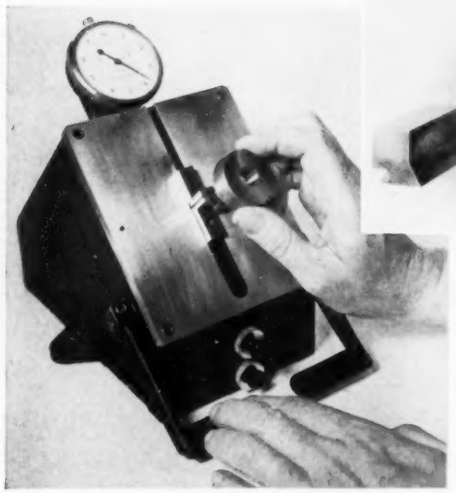
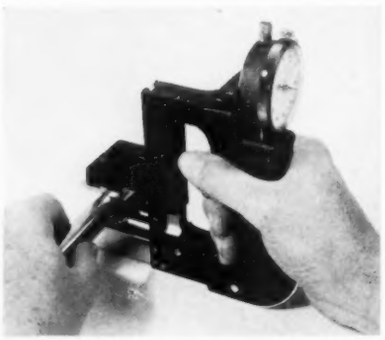


Fig. 2—Contact pressure on the Model 36B-6 comparator is adjustable with the two screws shown at the front of the base. Both inside and outside measurements are made easily

Fig. 3—Weighing only 1½ lb., the Model 1330 snap gage has a maximum jaw opening of 2½ in. Tungsten carbide inserts are used in the jaws



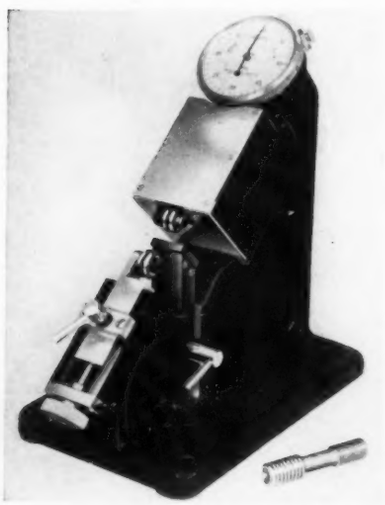


Fig. 4—Pitch diameters of various screws, bolts, thread gages and taps can be checked rapidly with the Model 45B-57 roller contact gage shown

Starrett No. 829 small hole gages use a split ball expanded by a cone

in. The dial reads to plus or minus 0.0015 in. Contact point is a diamond tip.

The Model 36B-6 internal and external comparator, shown in Fig. 2, has adjustable contact pressure. This gage checks the inside diameters of small holes and outside diameters or thicknesses of small parts for size, out-of-roundness, taper and bell mouth to less than 0.0001 in. The measuring contact point is mounted in such a manner that contact pressure is easily adjusted to definite required amount. Contact jaws are made to suit the requirements of the job and are interchangeable for different sized holes, or outside measurement. The dial is graduated to 0.0001 in. and the gage will measure inside diameters between 0.375 and 3.375 or any outside size up to 2.625 in.

Fig. 3 shows a Model 1330 adjustable snap gage in use. The upper jaw of this gage is adjustable for size of work and is fixed rigidly when in use. The lower jaw is one end of a simple lever, the opposite end of which contacts the indicator point directly. Jaws have tungsten carbide inserts and the face of the back stop is at an angle which automatically centers the work for different diameters. The dial is graduated to 0.0001 in. and the indicator has a range of 0.200 in. This gage weighs approximately 1½ lb. and has a jaw opening adjustable from 1 to 2½ in.

A Model 45B-57 thread pitch diameter gage with "John-Son" roller contacts is shown in Fig. 4. The lower roller of this gage is mounted on an adjustable slide, and the back stop for locating the work between the rollers is adjustable for different sizes of work. Both rollers are quickly interchanged and set for various sizes of threads. In using this gage, both hands are free to handle the work. The indicator shown mounted on this gage is graduated to 0.0005 in. and has a range of 0.300 in. Capacity of the gage is for diameters up to 1.00 in.

No. 829 Split Gages Measure Small Holes

Developed for measuring small holes and internal dimensions less than those ordinarily handled with telescoping gages, the No. 829 small hole gages offered by the L. S. Starrett Co., Athol, Mass., are available in sets of four gages, covering the ranges of ⅛–0.20, 0.20–0.30, 0.30–0.40, and 0.40–0.50 in. The end of

each gage is in the form of a split ball which is expanded by a cone controlled by the knurled knob at the end of the handle. The ball is placed in the hole, expanded to get the "feel" and the measurement transferred to a micrometer.

Table of Grinder Mounted on Balls

A precision surface grinder which employs ball bearings for all rotating shafts and is provided with ball tracks of hardened steel for table, saddle and spindle column travel has been announced by the Taft-Peirce Mfg. Co., 32 Mechanic Ave., Woonsocket, R. I. Construction of this grinder is claimed to permit uniform parallel and rectilinear motions and to eliminate inaccuracies arising from variations in temperature, oil film or wear of table and saddle ways. Mounting of the wheel spindle permits it to swivel in a vertical plane about the center of the wheel, thus simplifying set-up and adjustment. Working surface of the table measures 5 and 12 in., and maximum height under the wheel is 12 in. Net weight is 1500 lb.

Self-Contained Unit Cross-Drill Studs

Incorporating a "Govro-Nelson" automatic drilling unit, this self-contained drill head announced by Hole Engineering Service, 308 Stormfeltz-Loveley Bldg., Detroit, Mich., is adapted for use on screw machines and turret lathes for drilling cotterpin and other cross holes in studs and similar pieces. The unit is mounted on a special bracket which includes a bushing support in combination with a V-block stop. With this device, the cross holes are drilled in the studs before they are threaded, thus eliminating burrs. With a suitable riser block, the assembly can be mounted on the screw machine cross slide in line with the machine spindle, so that the V-block bushing support may be brought in contact with the work after the machine spindle is stopped.

Carbide-Tipped Gages Give Long Service

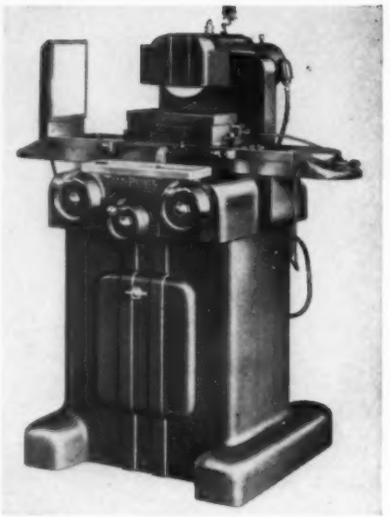
The Arthur A. Crafts Co. Inc., 532 Commonwealth Ave., Boston, Mass. is manufacturing gages and wear parts of solid Carboloy or tipped either with Carboloy or Stellite. These gages resist ordinary wear and are claimed to hold size indefinitely. All gages and wear parts are lapped with diamond dust, regardless of size or limits allowed. Gages are made to tolerance as specified by the American Gage Association, unless other tolerances are indicated by the purchaser. Ring gages frequently are made by inserting a liner of carbide or other hard material as shown in the accompanying illustration. Other typical gages include standard plug gages, turn gages, thread and dial gage contact points, hard facings for anvils and wear plates, and special gages of all types.

"High Cycle" Tools Have Interchangeable Parts

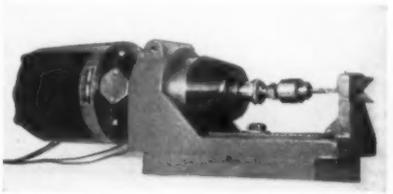
Special attention has been paid to interchangeability of parts between the drills, nut setters and screw drivers powered by the same motor in the line of "High Cycle" electric tools developed by The Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio. The No. 467-D drill shown is one unit of this line. It operates at 4,000 r.p.m., and has capacity for drilling $\frac{1}{8}$ in. holes in steel. Field casings and handles of these tools are made from heat-treated magnesium alloy in order to reduce the weight while maintaining the strength and rigidity of the tool. Parts subject to heavy wear are of malleable iron. The nut setters and screw drivers are equipped with triple action clutches which give uniform tension, and increase the capacity of the power unit. Both right angle and special angle attachment are available.

Westinghouse Welders Provide Close Regulation

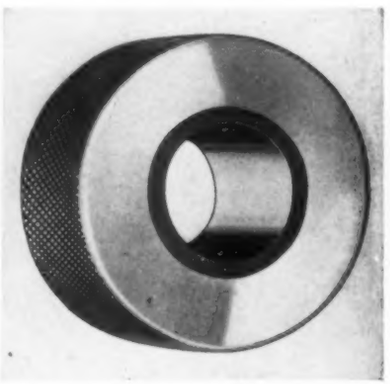
Both the 150 amp. "Flexarc" a.c. transformer-type welder and the 300-amp. "Flexarc" a.c. motor-generator set type welder offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., features convenient and accurate control of welding current. The 150-amp. unit, Fig. 1, employs the movable core principle of the design in which the position of a movable iron core within the reactor core determines the welding current. Core position is set by a handwheel located on the top of the welder; adjustment of welding current is obtained in an infinite number of steps by turning this handwheel. This unit has a welding range of 30–150 amp. and uses electrodes ranging from $\frac{1}{16}$ to $\frac{3}{16}$ in. in di-



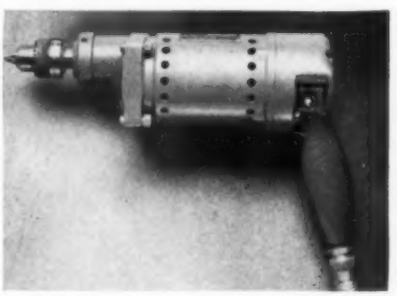
The wheel spindle of this Taft-Peirce grinder can be swiveled in a vertical plane



Feed and return of the drill is automatic on this cross-drilling head



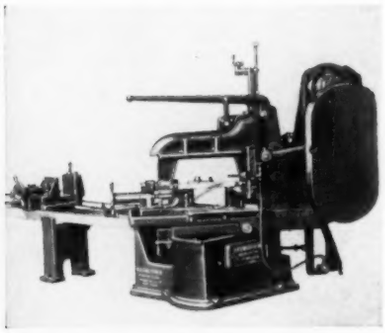
Gages made by Crafts have carbide inserts at wear points



Rotor Tool has developed a line of high-cycle portable tools for production operations

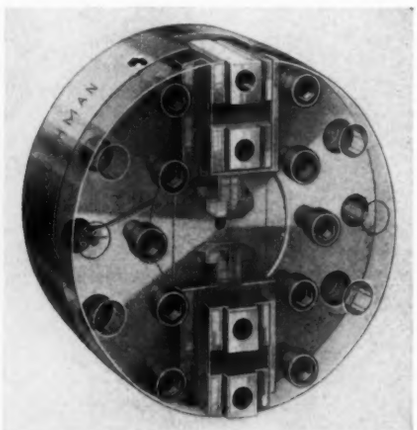
Fig. 1—This 150-amp. a.c. welder employs asbestos insulation on all windings

Fig. 2—Overhead welding is possible at high speed with this 300-amp. welder



Automatic bar feed is featured on this Rasmussen power backsaw

The "Motor-Flex" floor-type unit is made in three sizes.



This phantom view of the new Cushman chuck shows the actuating wedge

ameter. Open circuit voltage is 75 volts. This unit is 40 in. high over-all, and measures 22¼ in. deep by 18 in. wide.

Fig. 2 shows the 300-amp. motor-generator type welder which is claimed to maintain a steady arc despite voltage fluctuations caused by varying arc lengths. An improved method of controlling polarity reversal is claimed to prevent accidental reversal. Only one control handwheel is provided. This operates two magnetic plates inside the machine to provide an infinitely variable control of welding currents.

Automatic Hacksaw Has Swiveling Head

The Rasmussen Machine Co., 1014 Eighth St., Racine, Wis., offers an automatic metal-cutting power hacksaw suitable for multiple cutting operations either straight or at any angle up to 45 deg. The swiveling arrangement of the machine head makes it possible to install this equipment against a wall, or along an aisle, so that long bars can be cut conveniently. Feed of the bars through the chuck can be regulated in $\frac{1}{32}$ in. steps from 0 to 24 in.

"Motor-Flex" Unit Has Variable Speed

The multi-speed floor-type "Motor-Flex" flexible shaft unit is made in three sizes by the Martindale Electric Co., 1347 Hird Ave., Cleveland, Ohio. Motors used with the three sizes are ¼, ⅓ and ½ hp. respectively. Hinged construction of the jackshaft permits adjustment of belt tension and quick changes of pulley speeds. A full line of accessories, sanding disks and bands, buffing wheels, rotary files, and burrs are available for use with this flexible shaft unit.

No. 77 Lathe Grinder Uses a ½ Hp. Motor

Driven by a ½ hp. capacitor-start, induction-run or constant speed a.c. motor, the No. 77 precision lathe grinder offered by The Dumore Co., Racine, Wis., employs a V-belt drive, belt tension being set up sliding the motor base. A set of sheaves is furnished for speeds of 3,810 to 7,650 r.p.m., suitable for wheels from 3–6 in. in diameter. Standard quills can be used in this grinder for internal grinding holes down to

2⅞ in. in diameter, and up to 18 in. deep. Net weight is 45 lb.

"Angular Tooth" Saw Makes Clean Cut

Developed for cutting brass and copper tubing, the "Angular Tooth" type saw announced by Circular Tool Co., Inc., Providence, R. I., cuts without leaving a burr of sufficient size to require a burring operation. It is claimed to be particularly suitable for cutting tubing to be fitted in unions.

Keyless Drill Chuck Features Roll Grip

Three hardened and ground tapered rolls that run between a hardened cam and the drill shank hold the drill in the positive roll grip keyless chuck developed by Motor Tool Mfg. Co., 12281 Turner Ave., Detroit, Mich. These rolls are retained by a spider and, as the rolls climb the cam, they grip the drill shank. Only a slight twist is required to release the chuck. Tapered shanks provided with these chucks are tempered to resist wear and burring.

No. 36 Electric Hammer Has 2-In. Capacity

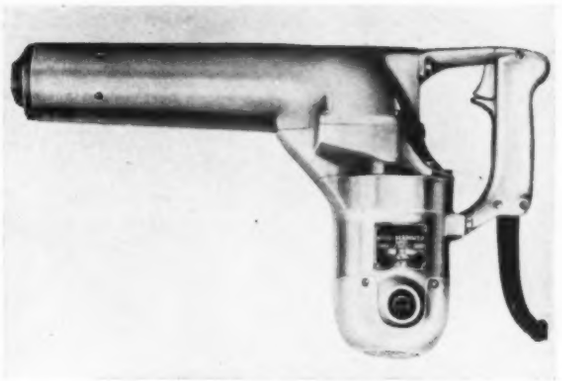
Providing 1,950 blows per minute, the No. 36 portable electric hammer, offered by the Black & Decker Mfg. Co., Towson, Md., has a capacity of 2 in. in concrete or brick. This tool weighs 23 lb., and has an over-all length of 20¼ in. The design of this tool includes a tool retaining spring and a trigger switch in the handle.

New Power Chucks Have Wedge Movement

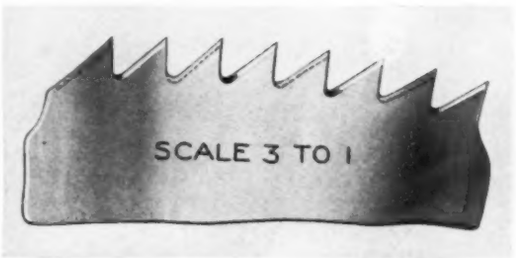
Available in 6, 8, 10 and 12 in. sizes, the Type 730 W.A.-1 two and three jaw powered chucks offered by the Cushman Chuck Co., 806 Windsor St., Hartford, Conn. have a wedge-type operating movement, and hardened steel bodies. Jaws have support from above and below, as well as at the center, and are claimed to prevent bell-mouthing. The chuck body is chip proof and serves as a lubricant reservoir.

No. 828 Center Finder Has Telescoping Pointer

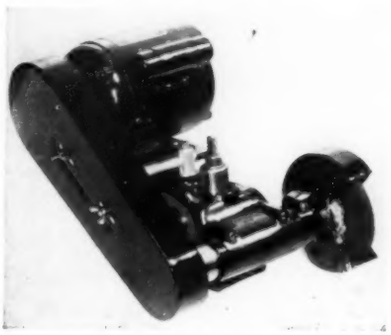
Consisting of a spring-tensioned pointer held in a tapered shank, with



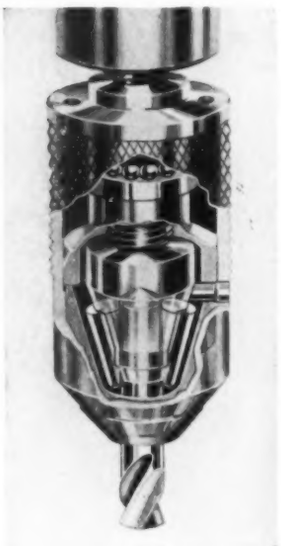
Approximately 1,950 blows per minute are struck by the No. 36 electric hammer



Practically no burr is left when brass or copper tubing is cut off with this circular saw

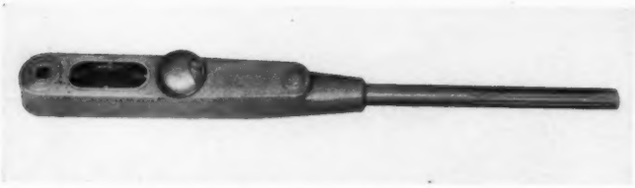


Holes up to 18 in. deep can be ground internally with the No. 77 grinder

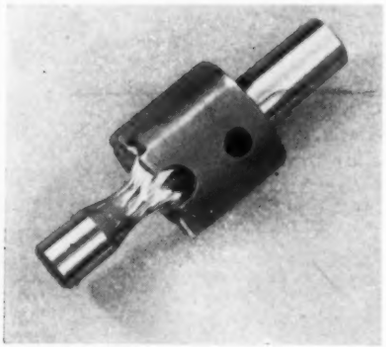


No key or wrench is required with the drill chuck offered by Motor Tool

Spring in this Starrett center finder protects the pointer against damage

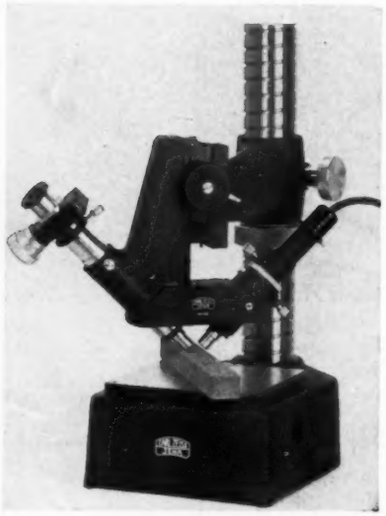


Ratchet adapters can be fitted to the "Ammco" tension indicators



A milled groove provides chip clearance in this Severance chamfering and facing tool

Developing unit of the Model E printer has a drip feed



Surface roughness is measured optically with this Zeiss instrument

Fork of the Model L lift truck can be elevated 53-in. above the floor

the pointer free to "wiggle", the No. 828 center finder offered by the L. S. Starrett Co., Athol, Mass., is designed so that the pointer can be telescoped into the body when not in use. With the center finder set in the chuck or tool holder of the machine, and the pointer guided to true concentric, it is a simple matter to bring the working point of any job into perfect alignment with the machine spindle. Tension of the spring which bears on a ball on the end of the pointer can be adjusted by a screw at the back of the shank.

Bolt Tension Indicator Made in Three Sizes

The "Ammco" tension indicator offered by the Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., North Chicago, Ill., is designed to tighten bolts to a predetermined stress. This tool is claimed to prevent distortion, insure accuracy, and provide uniform tension for all bolts in an assembly. The three sizes have capacities of 0-175, 0-420 and 0-1,000 ft. lb. respectively.

New Chamfering Tool Also Faces Tube Ends

A combination tool for inside and outside chamfering tube ends, and for facing the end of the tube at the same operation, has been announced by Severance Tool Mfg. Co., 1520 E. Genesee Ave., Saginaw, Mich. This tool is provided with one facing cutter which may be removed for regrinding, replaced and adjusted independently, of the inside and outside chamfering members. It is provided with a pilot to guide the tubing into the cutter centrally.

New "Zeiss" Microscope Measures Surface Roughness

A finish measuring microscope, announced by Carl Zeiss, Inc., 485 Fifth Ave., New York, N. Y., measures the depth of machining marks by means of a micrometer ocular. A narrow luminous slit is projected at 45 deg. on the machining marks of the surface under test by a concentrated beam of light. This amounts to a cross section through the "roughness" of the surface which is observed through a microscope, also placed at 45 deg., and a magnified luminous band is observed. Magnifications of 80X, 145X and 240X are provided.

Finishes down to fine grinding can be measured with high accuracy, and it is claimed that readings can be repeated within narrow limits. The instrument can be used either on a substantial base, as shown, or may be held in a V-fixture so that it can be placed on a shaft while in, for instance, a grinder.

Model E White Printer Is Self-Contained

The Model E white print machine offered by Ozalid Corp., 354 Fourth Ave., New York, N. Y., combines an improved printer with a developing unit in a single machine. The machine will handle sensitized material up to and including 42 in. wide at speeds up to 30 linear in. per min. The complete machine is 56 in. wide, 18¼ in. deep and 18 in. high. The printer includes a rotating glass cylinder, providing rolling contact and insures maximum utilization of the light rays emitted by a single Cooper Hewitt mercury vapor lamp. All air entering the cylinder for cooling the mercury vapor tube is filtered to minimize dust deposits on the burner contained within the glass cylinder.

Model L "Towmotor" Is Gasoline-Powered

The Model L "Towmotor" fork truck developed by Towmotor Co., 1226 E. 152nd St., Cleveland, Ohio, has front wheel drive and rear wheel steer with seated center control. This gasoline-powered lift truck can be turned at the intersections of 78 in. wide aisles. The fork column can be tilted forward 5 deg. or back 10 deg., and the forks can be elevated to a height of 53 in. above the floor. Maximum length of this unit with the standard fork is 127 in., while over-all height is 83 in.

"Shear Clear" Cutters Force Chips from Cut

The cutting edges of "Shear Clear" face milling cutters announced by the Ingersoll Milling Machine Co., Rockford, Ill., have been set at an angle that moves the chip away from the surface cut, so as to eliminate any packing of chips in the face of the cutter. The finished surface is not scored by chips being dragged along it. To accomplish this result, the cutting blades are set at negative rake and steep positive shear angles. The corner of the cutting angles is broadly chamfered off to direct the chips outwardly. The combination of angles and chamfer is varied to suit the work being done.

Type B-2 Seamless Hose Has Integral Couplings

Couplings at each end of the Type B-2 flexible, seamless all-metal hose announced by Seamlex Co., Inc., 5–19 48th Ave., Long Island City, N. Y., are joined to the seamless bronze tube and bronze braid by brazing. Recommended for high temperatures, these hose units also can be made of aluminum and steel. They are available in standard pipe sizes from ¼ to 3½ in. inside diameter.

Improved Drill Chucks Balanced by Grinding

Improved drill chucks announced by the Jacobs Mfg. Co., Hartford, Conn., feature sleeves that are internally ground on three diameters after heat-treatment, so that they will fit the body of the chuck. This is claimed to put the chuck in better balance than formerly was possible. Since the improved sleeve fits the body closely, the nut which operates the jaws is held concentric. The fluted sleeve provides a better grip and, at the same time, is easier on the operator's hands, since the flutes have a rounded contour.

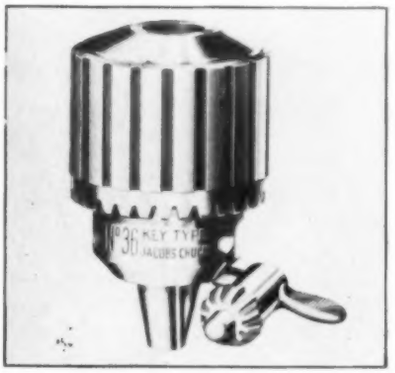
"Speedway" Hoist Made in Three Types

The "Speedway" light-weight wire rope electric hoist announced by the Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa., is made in sizes having capacities ranging from 250 to 750 lb. and with hoisting speeds of 15 to 43 ft. per min. Standard construction includes a fully inclosed ball bearing motor, anti-friction bearings, cut steel spur gears, multiple disk solenoid brake, pushbutton control, performed hoisting cable and lug, hook or trolley suspension.

Cast High Speed Steel Is Abrasion-Resistant

A cast high speed steel, which can be hardened and drawn to show Rockwell hardnesses from C-60 to C-72, has been developed by the Gorham Tool Co., 14400 Woodrow

"Shear Clear" cutters have inserted blades of high speed steel, J-metal or cemented carbide

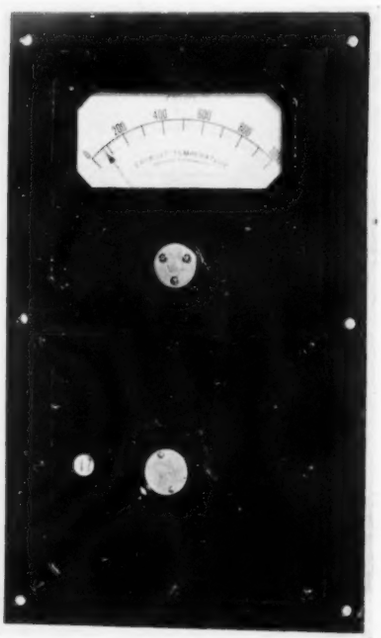


Improved Jacobs drill chucks have internally-ground sleeves

Lug, hook or trolley suspension types of the "Speedway" hoist are available.

B.-C. face shields are mounted on an adjustable head band

Both single and double hook types of this two-speed hoist are available.



An automatic cold end compensator can be incorporated in this meter

Wilson Ave., Detroit, Mich. This material has a high alloy content, since the casting process is claimed to allow the inclusion of higher percentages of alloys than is possible in forgeable high-speed steels. Flat tools are cast individually or cut from cast plates, and circular tools are either cast in disks or cut from cast bars. Casting strains are relieved by annealing. In the annealed state, this material is free machining. In the hardened state, it has a comparatively fine grain structure with a strength comparable with that of forged high speed steels. Abrasion-resisting properties of the cast high speed steel are such that it can be used for making straight side milling cutters and keyway cutters.

B.-C. Face Shields Provide Full Vision

Developed to provide protection in practically all types of industry, these face shields announced by the Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich., are light in weight and offer no obstruction whatever to vision. The No. 40 shield shown is of sufficient size to permit the wearer to use it over his prescription glasses. The smaller No. 10 shield is of lighter construction and is arranged to fit close to the face.

Two-Speed A.C. Hoist Requires Little Headroom

Built in capacities ranging from ¼ to 6 tons, the two-speed a.c. hoist offered by Electro Lift, Inc., 30 Church St., New York, N. Y., is designed to provide slow speeds for starting, inching, running and stopping, and fast speeds for efficient handling of materials. The design includes a squirrel cage a.c. motor which drives a worm and worm wheel running in roller bearings. The hoist has close headroom, allowing the hook to reach within a minimum distance of the overhead track. It has a safety type hook block with a guard which completely incloses the bottom sheave.

"Alnor" Pyrometer Has Flush-Type Case

Similar to the front-of-board rectangular pyrometer announced some time ago, this rectangular multi-point "Alnor" pyrometer offered by Illinois Testing Laboratories, Inc., 420 N. La Salle St., Chicago, Ill., has a case arranged for flush mounting on the control panel. This pyrometer is equipped with a selector switch having 8, 17, 25, or 28 points. The case is provided with a sealed back which excludes moisture, fumes and dust. These instruments can be furnished with ranges of 0–300 F. to 0–3,000 F.

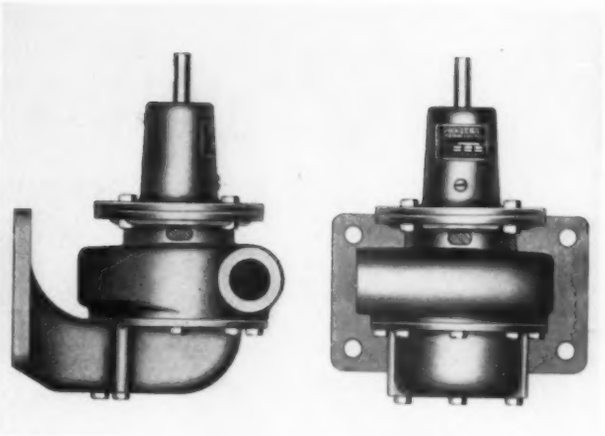
"600" Bearing Metal Has High Strength

In the form of forgings or parts made from drawn rod, the "600" bearing metal offered by Mueller Brass Co., Port Huron, Mich., is claimed to have a tensile strength several times that of the best cast bearing bronzes. This material can be forged or drawn to a variety of sizes and shapes and is adaptable for fabrication in modern automatic machines. This material has a melting point of 1,625 F. and a weight of 0.2916 lb. per cu. in. Forgings of a tensile strength of 80,000–90,000 lb. per sq. in., and a brinell hardness of 160–175. The material machines approximately one-half as fast as brass; a cutting speed of 125 ft. per min. is recommended when the tools are flooded with coolant. Due to a high coefficient of expansion, this alloy requires a slightly greater clearance than other bearing metals.

New Coolant Pumps Have Open Impellers

Designed especially for use in conjunction with machine tools or auxiliary tanks where the unit must be driven with a flat or V-belt, chain, gear or flexible coupling, or where it is impractical to mount motorized models, a series of open-impeller coolant and lubricant pumps announced by Pioneer Engineering and Mfg. Co. Inc., 3 Melbourne Ave., Detroit, Mich., are interchangeable with other standard pumps regularly furnished by this company. The Model FV and Model FB-V vertical pumps are designed so as to be submerged directly into the tank or reservoir and to be attached to the side of the tank or machine as required. The Model F-VB pump shown is built to mount on the side of a coolant tank or machine pedestal for close coupled installation. No auxiliary inlet piping is required. All of these units are built in capacities up to 175 gal. per min., and for pressures up to 53 lb. per sq. in. They are of the open-impeller type and abra-

sives or other foreign matter in suspension in the liquid being pumped will not damage these units. A special mechanical seal, designed so as to eliminate shaft friction and the need for repacking, is used. This also is said to eliminate the necessity for maintaining pump locations in relation to liquid level, particularly in the F-VB model. These pumps require no relief or by-pass valves in the delivery line to protect the pump when the coolant supply is throttled.



Abrasives suspended in the liquid are said not to damage these Pioneer pumps

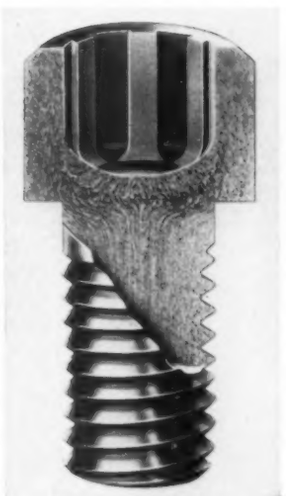
B.-S. Profile Grinder Designed for Tool Work

Similar in design to the bench model profile grinder previously described (AM—Vol. 82, page 385), this floor-type heavy-duty profile grinder offered by Boyar-Schultz Corp., 2110 Walnut St., Chicago, Ill., has a vertical spindle operating at 10,000 r.p.m. Drive is from a 2 hp. ball bearing motor. Work table has a sine-bar adjustment to give any angular setting up to 5 deg. The revolving spindle is adjustable to provide reciprocal movement in a vertical plane. All controls are conveniently located at the front of the machine. All parts of the drive mechanism, including the motor, are located within the pedestal base of the grinder, with full protection against abrasive particles.

Vertical spindle of the Boyar-Schultz profile grinder can be reciprocated

"Bristo" Cap Screws Have Splined Sockets

Fibrous grain structure of the "Bristo" cap screw announced by the Bristol Co., Waterbury, Conn., is shown in the accompanying illustration. The head of the screw is formed by a process designed to produce the splined sockets by extrusion.



"Bristo" cap screws have extruded splines in the socket-type heads

Variable Transmission Is Instantly Adjustable

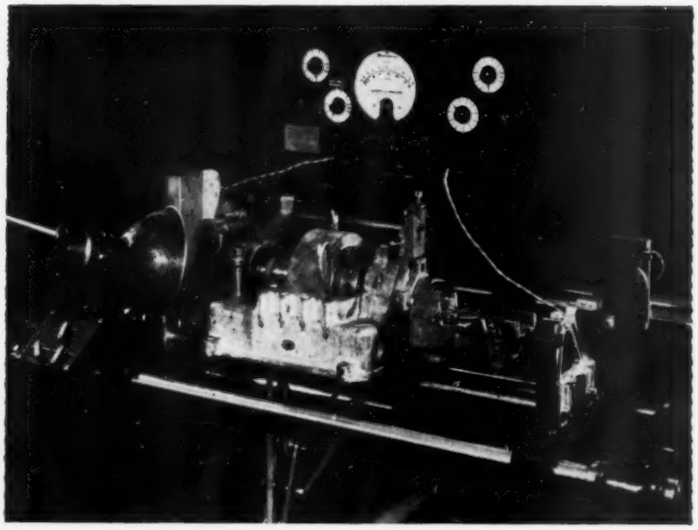
In the improved infinitely variable speed reducing transmission offered by The Lenney Machine & Mfg. Co., Warren, Ohio, a hardened steel roller in contact with a hardened steel driving disk is used to transmit power. An automatic loading device maintains contact pressure of the roller against the disk in proportion to the load imposed on the output shaft of the transmission. The speed indicating dial is located at the top of the unit and is so graduated that predetermined speeds can be selected readily. An integrally mounted motor of either 1,150 or 1,750 r.p.m. completes this unit.

Capacities of $\frac{1}{8}$ to $7\frac{1}{2}$ hp. are available in the improved Lenney transmission

Wheelhead Balancing

Champion has adopted a novel method of dynamic balancing to eliminate run-out and chatter on spark plug parts

By RUPERT LE GRAND
Detroit Editor, American Machinist



Grinding wheel, spindle and mounting are placed on V-blocks and balanced so that vibration is reduced to less than 0.00005 in.

GRINDING WHEELS and spindles are usually removed from their mountings for balancing, but it remained for the Ceramics Division of the Champion Spark Plug Company to balance these rotating parts while running on their own bearings and in their own mountings. This operation is being done on the Dynetric balancer, made by the Gisholt Machine Company and fitted with Westinghouse instruments and stroboscopic apparatus for detecting the amount and angle of unbalance.

Previously Champion had to dress the form on the wheel while on the spindle, statically balance the wheel and spindle on ordinary roller ways and replace the spindle in its bearings in the wheelhead mounting. This procedure gave no assurance that the wheel would not run out and cause vibration and chatter. Since installation of the new balancing machine a few months ago, the entire wheelhead is removed from production to a special dressing and balancing room. Here the head assembly is placed in a special machine to have the wheel redressed or cut to a new contour by a diamond nib. Since this operation is done with the wheel and spindle mounted in their own precision ball bearings, the danger of run-out is eliminated. For the second operation, the entire wheelhead assembly is transferred to the Dynetric balancer and is lowered on V-type supports in the balancing machine.

Lock screws prevent undue vibration of the balancing machine structure while the work is loaded; while balancing the assembly these lock screws are freed. Then a belt is passed around the driving pulley on the wheel spindle for driving the work at its operating speed while measuring and locating the unbalance for subsequent corrections. This belt also passes around the balancing driving motor pulley; weight-operated idler pulleys take up the slack.

The grinding wheel is held between two flanges which have 24 equally spaced $\frac{1}{8}$-in. pipe plugs. An identifying number is marked on the flange adjacent to each plug. To correct the unbalance, plugs of proper weight are substituted for those already in the holes. These plugs are available in a variety of weights, namely $2\frac{1}{2}$, 3, $3\frac{1}{2}$ and 4 grams.

The balancing machine is provided with a large direct-reading meter which indicates the amount of reduction of weight of pipe plug in either the right or left flange. It is also provided with a stroboscope lamp which will permit the reading of the number on the flange identifying the plug to be changed for balancing. An operating control box has three switches. The first switch is for the selection of either the right hand or left hand flange for balancing correction. The second switch is marked "amount" and "angle" and permits the reading on the meter of the amount of weight to be removed for balancing correction, and the location of the pipe plugs that have to be changed. The third switch selects either the high or the low range of meter sensitivity.

In operation the operator depresses a foot switch which brings the rotating part up to its normal operating speed. Then, by manipulating the switches, he reads the amount of weight reduction in the right and left hand flanges necessary to give balance and, from the stroboscopic lamp, he identifies the plugs.

The shop has 110 grinding heads in service and often only ten heads are removed per day for redressing and balancing. Each wheel is dressed once per week, because otherwise the grains become dull and production falls off. The wheel contour is not lost. Thus, the balancing machine is not kept in constant use, but the management has been trying to get an appropriate balancing machine for years because it realizes that elimination of vibration and chatter assures precision work (diameters are checked to a thousandth) and that the precision wheel spindle bearings will give longer and better service. There is also a considerable saving in time from the old method of balancing on rolls and gouging the sides of the wheels to obtain balance. The time saving is considered less important than the better results obtained in a production grinding shop that turns out 6,000,000 insulators per month.

THE CEMENTED CARBIDES

As Used in Metal-Cutting Tools

DURING THE World War, the Krupp Works in Germany developed tungsten carbide, with cobalt as a binder, for wire drawing dies. From 1920 to 1922 this concern experimented with the new material on machining applications, obtained a basic patent in 1923 and a U. S. patent in 1924. Five years later the General Electric Company entered into a license agreement with Krupp and formed the Carboloy Company. In November, 1928, Carboloy and the Firth-Sterling Steel Company offered cemented carbide for commercial use. Since then a number of other concerns have entered the business of supplying cemented carbides for cutting applications.

About 75 per cent of present applications can be taken care of with two grades of cemented carbide—a cast-iron grade and a steel-cutting grade. These two grades are usually sufficient for the jobbing shop which is not often in position to take full advantage of the special grades. Other grades are mainly intended for the production shop, where a service engineer can check all the many factors in the set-up and then make a recommendation based on his knowledge of the material's composition and method of manufacture.

FORMS AVAILABLE

Certain forms of cemented carbide are available, and their cost decreases in descending order, as follows:

1. Finished tools.
2. "Milled and brazed" tools—those on which all operations have been completed except grinding. This form is practical for the user: (a) where proper grinding facilities are available for single-point turning, facing and boring tools; (b) where intricate shapes are more cheaply ground in the customer's plant with his own special equipment; and (c) where plants use a number of varied shaped tools within a slight range of modification.
3. "Brazed only" refers to tools for which the customer furnishes the shank and the vendor brazes a tip to the shank and returns it for grinding. This service is ordinarily confined to tools having intricate shank shapes which require special equipment and methods to machine economically and, therefore, are best machined with the user's own equipment.
4. Blanks only. Job shops and small manufacturers with limited production can maintain a low investment through a small stock of blanks, making up tools as needed and removing the tips for use on other jobs.
5. Solid cemented carbide tools. Solid tools may give a lower over-all cost on certain work than inserts in heavy tools.

METHOD OF HOLDING

In precision boring tools, a solid carbide tool bit should be held so just the cutting edge is exposed and support is brought out practically to the bottom edge of the tool. Some users believe that solid tools give better performance because they are not subjected to brazing heat; but authorities hold that the brazing heat will not affect the strength of the carbide and that a solid bit gives better performance because it is not subject to stresses set up either in brazing or by unequal expansion of bit and shank material in service.

Solid tools have been tried experimentally on interrupted cuts and have not broken.

TIP SIZES

Lathe tool blanks have been standardized so that 90 per cent of the tools in use today can be made cheaper by grinding a stock size in the user's shop to modify it slightly instead of buying a special shape. The three styles—rectangular, rectangular with one rounded corner, and with a 60-deg. nose are made 0-0.015 in. oversize in thickness and width and 0-0.020 in. oversize in length to allow for finish grinding. Sizes of the plain rectangular and rounded-corner rectangular blanks range from $\frac{1}{16} \times \frac{5}{32} \times \frac{1}{4}$ in. long to $\frac{1}{2} \times \frac{5}{8} \times 1\frac{1}{4}$ in. long. The 60-deg. nose tips are available in sizes from $\frac{1}{16}$ in. $\times \frac{1}{8} \times \frac{5}{16}$ in. long to $\frac{5}{16} \times \frac{5}{8} \times 1\frac{1}{4}$ in. long.

Proportions of these rectangular blanks range from squares to shapes in which the length is four times the width and the width is four times the thickness. In severe use, a long thin insert may give way. In such cases, it is preferable not to exceed the following proportions: width not more than twice the thickness and length not more than twice the width.

Due credit is given the following organizations for data supplied by them in the preparation of this section.

American Cutting Alloys
Carboloy Company
McKenna Metals Company
Vascoloy-Ramet Corporation
Firth-Sterling Steel Company

TOOL SUPPORT AND TOOL HOLDERS

The proportions of tip and shank are important. Cemented carbides have about half the transverse rupture strength (resistance to bending) of high-speed steels. Obviously a shank equivalent in thickness to a high-speed steel tool should not be used. Recessing such a shank gives less strength than before. The shank thickness must be at least equal to that of a high-speed tool plus the thickness of the tip.

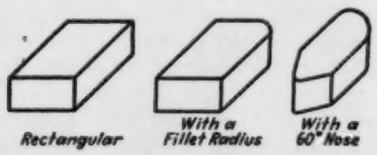
Redesign of the tool support may be necessary, such as machining it to take the larger shank. One method of increasing tool support is to add an integral support to the tool block in order to brace the projecting end of the tool. Such a support may be designed to minimize the deflection caused by side strains on the tool.

In any case, the tool block should extend so that the overhang is kept to a minimum. The overhang should never exceed half the thickness of the shank under the tip. Extensions can be welded to the old block if necessary.

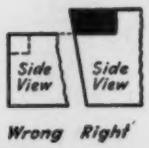
Another method is to mill a step in the shank and to back the shoulder thus formed firmly against the tool block. The portion of the shank overhanging the tool holder should preferably be made wider than standard to increase its strength. Deflection takes place in the weaker section of the shank and reduces the possibility of bending at the tip. Experimental tools now embody the action of a spring toolholder to minimize this bending effect.

Still another method uses a special toolholder fitted with a solid carbide toolbit resting on a hardened high-speed steel backing-up plate. Pressure applied to the chip curler by two setscrews holds the toolbit in place.

Standard toolholders are unsatisfactory for cemented-carbide toolbits because the front clearance angle and top rake are excessive for proper strength of the shank material under the tip. New type toolholders are designed especially to hold the cemented-carbide tipped toolbits horizontally.

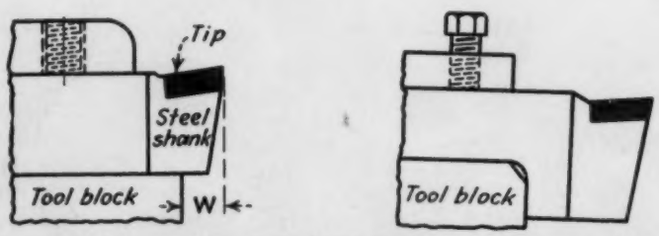


These three standard shapes of lathe tool blanks are available in a variety of sizes with a grinding allowance for finishing

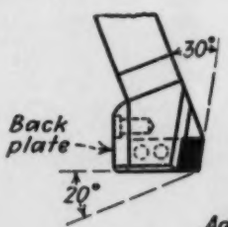


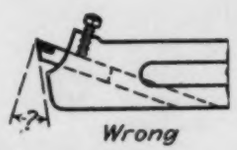
Shank size should be increased in order to compensate for the recess

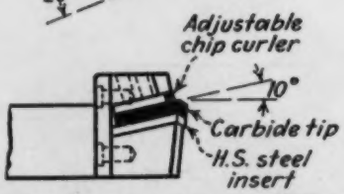
At *A* is a conventional tool block. The auxiliary support shown at *B* has been added at the bottom of the tool. Another design *C* supports the tool sidewise as well as vertically



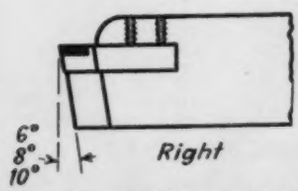
Two tool holding devices are designed to add rigidity. In one the tool block is extended to reduce the overhang *W*. In the other the shouldered shank has an extra heavy tip section







In this tool the carbide tip is held in a special holder on a high-speed steel insert by means of a carbide tipped chip curler



While conventional tool holders (above) do not work well with the carbides, special designs (below) are particularly suited for this purpose

TIP THICKNESS

Tip thickness is ordinarily 25 per cent of the tool thickness. Few operations in the automotive industry require tips thicker than $\frac{3}{32}$ in., because the depth of cut seldom exceeds $\frac{1}{8}$ in. and the time of cutting is measured in seconds. Under these conditions the amount of heat to be dissipated to the shank is not great. With long heavy cuts in chilled rolls, for example, a tip which is not thick enough and which does not afford a large area of contact with the braze will concentrate the heat at the braze line. For long heavy cuts in steel, the tip thickness and shank height should be increased about 50 per cent, but still maintaining tip thickness equal to 25 per cent of total thickness.

METHODS OF TIP BRAZING

The tip and shank are assembled by brazing, which is carried out at temperatures from 1,450-2,120 F. Such temperatures have a heat-treating effect on the shank material, and thought must be given to the effect of heat on the steel with respect to causing grain growth and distortion. Time must be allowed for the two materials to cool down uniformly and slowly to minimize setting up stresses in the braze after it freezes.

For most applications S.A.E. 1045 and 2340 are considered satisfactory shank materials. For tools that must stand abuse and have higher strength, a silicon steel may be selected. High-speed steel (18-4-1) is occasionally used where hard shanks are required.

There are two methods of brazing cemented tips to tools:

1. Furnace brazing, with or without hydrogen as a furnace atmosphere, using thin sheet or pellet copper, tobin bronze, or silver solder as the brazing material.

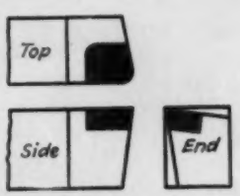
2. The oxyacetelene torch, using either tobin bronze or silver solder to make the joint.

Copper melts at 1,983 F., makes a joint of adequate strength and has the greatest resistance to softening from the heat of cutting. It is the material most used by manufacturers of cemented carbides in fabricating tools for the trade. Tobin bronze melts at 1,625 F. and is used for some torch brazing. Silver solders melt at 1,270-1,350 F., and most tools can be brazed satisfactorily with these materials.

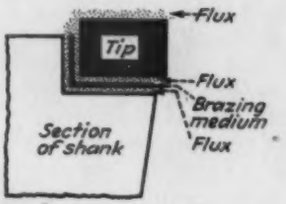
Good brazing depends on:

1. Correct recessing of the shank;
2. Clean surfaces of recess and tip;
3. Correct heating and cooling of the assembly;
4. Liberal fluxing;
5. Consideration of expansion and contraction which might crack the tip.

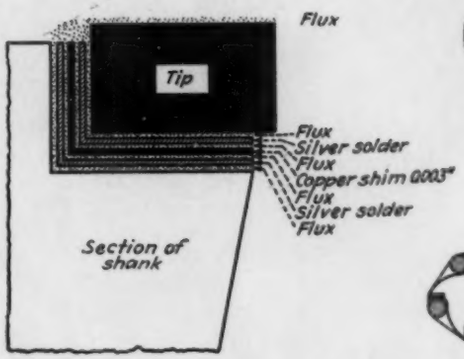
The recess should be milled flat to provide a good bearing surface for distribution of the cutting pressure. It should not be more than $\frac{1}{64}$-in. oversize. Standard blanks may be touched to the flat surface of a wheel even though made accurately flat to give the best surface for alloying with the braze. The edges should be chamfered where they might interfere with a fillet in the recess. Surfaces on special tips should be ground to fit the recess accurately. Both recess and tip should be cleaned with carbon tetrachloride to remove grease and finger marks.



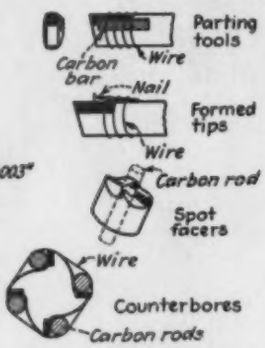
This standard design of tip recess is designed to give the carbide support on three sides



The common method of tip application is shown with the brazing medium between tip and shank



In the "sandwich" braze the tip is brazed separately to a central shim before assembling with the shank



Various means for holding tips to tools during the brazing process are illustrated. Carbon rods will not fuse

RECOMMENDED TIP THICKNESSES

For Machining Cast Iron, Brass and Malleable Iron for General Shop Work

ROUGHING

Feed Up to	Depth of Cut in Inches									
	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{5}{32}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{1}{4}$	$\frac{9}{32}$	$\frac{5}{16}$
0.020	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
0.030	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
0.040	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
0.050	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
0.060	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$

FINISHING

Feed Up to	Depth of Cut in Inches							
	0.030	0.040	0.050	0.060	0.070	0.080	0.090	0.100
0.006	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
0.012	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$

FURNACE BRAZING

The hydrogen-atmosphere method of furnace brazing may be used for all brazing materials—copper, tobin bronze and silver solder. For controlled-cycle furnaces, flux the recess, line the recess with sheet-brazing material, add more flux and fasten the tip firmly in place with No. 28 Nichrome wire. The assembly is then pushed into the controlled preheating, brazing and cooling zones in the furnace. In the case of small hydrogen-muffle furnaces, the assembly is placed in the muffle with proper observance

of effects of preheating and especially cooling.

Recommended temperatures for brazing are: copper, 2,100-2,120 F.; tobin bronze, 1,700-1,800 F.; silver solder 1,450-1,500 F. These temperatures are well above the melting points of the respective materials.

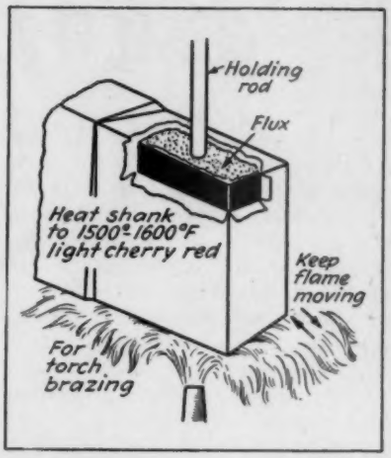
The sandwich braze is preferred when the tips have a dimension of ¾ in. or more or when hard tungsten carbide and tungsten-titanium carbide are used in any size of tip. A more flexible joint is obtained by brazing the carbide to a central harder shim and the shim in turn to the shank. When brazing with silver, the shim is copper, and when brazing with copper the shim is nickel or constantan.

In another method for furnace-brazed assemblies the shank is coated first with borax or proprietary flux and preheated to 1,500 F. in a small hydrogen-atmosphere, low-heat muffle. Only the recessed end is heated, then withdrawn, and the tip slipped in place with enough copper on top. The tool is then placed in the high-heat muffle until a temperature of 2,050 F. is reached, when the copper melts and runs down into the joint. At this point the assembly is withdrawn and the tip is pressed with a steel rod to squeeze out excess copper and flux. The tool is then covered with powdered carbon and allowed to cool.

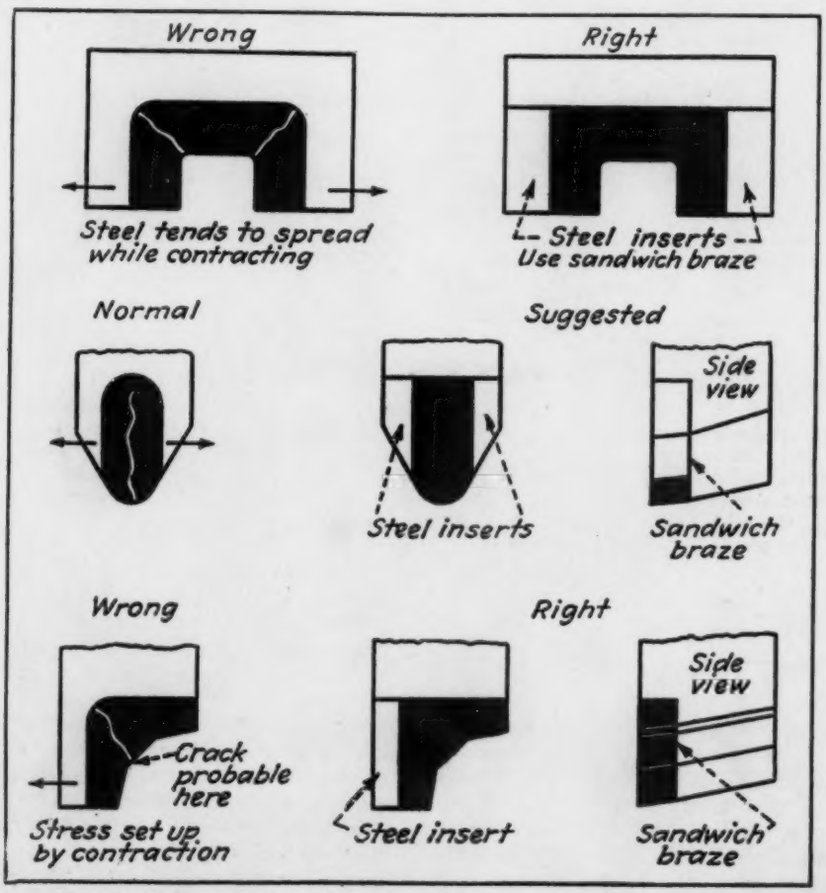
TIPPING WITH A TORCH

In torch brazing with bronze, the shank is heated from underneath with a non-oxidizing flame until borax or a proprietary flux applied to the recess runs freely. Then "tin" the recess with a $\frac{1}{16}$-in. tobin bronze rod (60 copper, 1 tin, and 39 zinc), allowing it to melt and run. Place the tip in the recess, cover with flux and heat the underside of the tool until the flux and bronze are again melted. Press the tip firmly in place with the tang of an old file or steel rod. Allow to cool slowly.

When silver soldering, flux the shank recess, tip and the thin sheet silver solder cut into pieces to fit the bottom and side of the recess. Put the tip in place and hold it down with a steel rod. While silver solders flow at 1,270-1,325 F., it is desirable to heat the shank to 1,500-1,600 F. (a bright cherry red) to assure that the solder thoroughly wets the cemented carbide and forms a satisfactory bond. Cool the assembly slowly in powdered hard coal, asbestos, lime or mica to prevent cracking the tip during cooling. Remove the excess flux with hot water or by brushing. When furnace brazing silver solder joints, wrap the tip and shank assembly with Nichrome wire.



In torch brazing, the tip is held in place while the flame is passed back and forth beneath the shank



Certain changes can be made in tool design to overcome brazing strains

CARBIDE TOOL DESIGN

General instructions on cutting and clearance angles are as follows:

1. Keep the final front or side tip clearance angles as small as possible and still clear the work. Grind the front and side relief angles the same. In general, the correct relief angles will be: for iron and non-ferrous materials, 4-6 deg.; for copper and aluminum, 8-10 deg.; for steel, 8-10 deg.

2. In order to reduce grinding time, hold the shank clearance angle, front or side, to 2-5 deg. greater than the relief angle.

3. Hold the end cutting angle as small as possible to get the greatest point angle, which means the greatest point strength.

There are several advantages of using a large side cutting edge angle; this may range up to 60 deg. Advantages are:

1. It increases the strength of the tool nose.

2. With a 45-deg. angle the chip thickness equals only 70 per cent of the feed.

3. It distributes the cut over a longer portion of the tip and decreases the unit pressure.

4. It allows the starting load to be taken on the tip at a point back of the nose, where the tool is stronger.

However, it should be noted that a side cutting edge angle in excess of 45 deg. frequently induces objectionable chatter.

A large point radius from $\frac{1}{16}$ to $\frac{3}{16}$ in., will effect the same benefit as a large lead angle. Make the point radius as large as possible without causing the machine to chatter. A large point radius is especially important on heavy work because it distributes the chip pressure.

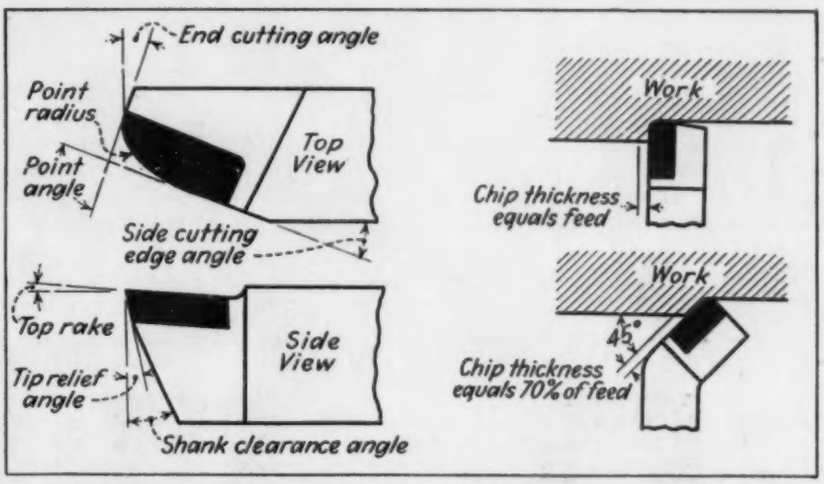
When using a positive back rake for steel turning, it should be kept small to give greatest strength in the tip. For rough heavy cuts, particularly intermittent cuts, a negative back rake removes the starting impact from the point or corner of the cutting edge to a point farther back where the tip is stronger and better supported. Negative rakes increase the power required and do not cut as smoothly as positive rakes. A general guide is: for rough cuts and old machines, 2–4 deg.; for rough cuts on shapers and planers, from 6–10 deg.; for rough cuts on steel castings, old and new machines, 2 deg. Compensate for negative back rakes with side rakes.

Side rake is the cutting angle on side cutting tools. The correct combination of back and side rakes gives accurate chip control in steel cutting. Present practice leans toward providing a combination of angles that will curl the chip in the direction desired. Certain types of accessory chip control devices may be used, or a chip curler may be ground in the tip. Some tools have such steep side rake that an accessory carbide-tipped chip curler must be applied.

The best side rake for any particular job may be anywhere within the limits shown in the accompanying table, or may, occasionally, be above or below them. Tests on turning nickel-chrome steel bars in a lathe show that a side rake angle of about 20 deg. gives the maximum tool life.

SUGGESTED GRINDING PRACTICE

Because of extreme hardness, cemented carbides cannot be ground with the same wheels as high-speed steel and Stellite. Grinding wheel wear is higher, and there is a tendency for the material to crumble at the cutting edge and to check throughout the tip during grinding. Speeds ordinarily recommended for machine grinding range around 2,000 surface ft. per min. On the steel-cutting grades of carbide with over eight per cent titanium or twelve per cent tantalum content, the thermal conductivity is much lower than with straight tungsten carbide. Therefore, in machine grinding careful handling is necessary to avoid cracking. Hand grinding can be done at higher speeds because the tool is free to oscillate in the operator's hand. Dry grinding is preferable for either of these steel cutting materials. On regular tungsten carbide wet grinding with kerosene or common grinding solution gives improved results even when Bakelite bonded diamond wheels are used.



A good sized side cutting edge angle and a large tip radius help to distribute the cutting load

The side cutting edge angle reduces the thickness of the chip in proportion to the feed

WHEEL TYPES

Grinding is done with two types of wheels:

1. Special silicon-carbide wheels that are hard, sharp, somewhat friable, and bonded so an open, porous wheel structure results.

2. Diamond wheels in grits from 100–500. Wheels with one of three bonds may be used: one which is open and porous and is adapted for general offhand and machine grinding; one which is slightly more dense and is used wherever maintenance of a particular shape of face is important; and another which is strong and dense and is used for narrow grooving where a thin wheel is required.

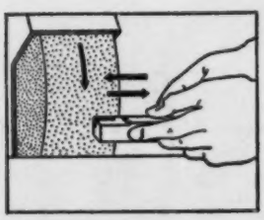
Diamond wheels, while more expensive than silicon-carbide wheels, are faster and cooler cutting on machine grinding, and can be expected to show savings because of time saved and extremely low rate of wear. Flat lands are practical with machine grinding, and these often give two to four times as many pieces per grind as tools reconditioned on slightly rounded silicon-carbide wheels. Furthermore, the finish is smoother, which is important to prevent adhesion of the chip and cratering action, particularly when machining alumi-

APPROXIMATE SIDE CUTTING RAKES

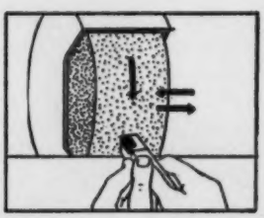
	Degrees
Normal cast iron	10–15
Semi-steel castings	5–10
Very hard or chilled iron	0–2
Mild steel up to 0.20 C	15–25
Carbon steel, 0.20 to 0.60 C	8–15
Steel over 0.60 C and tough alloys	5–10
Copper and aluminum	10–40
Brass and bronze	0–5
Non-metallics	5–15

WHEELS FOR GRINDING CEMENTED CARBIDE TOOLS

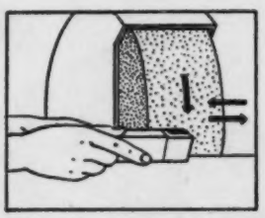
TOOL	OPERATION	ABRASIVE	GRAIN	GRADE	BOND
Lathe and planer tools	Roughing, offhand, on straight or cup wheel	Silicon-Carbide	60	Soft	Vitrified
		Damond	100		Resinoid
	Finishing, offhand, on cup wheels	Silicon-Carbide	100 or 120	Soft	Vitrified
		Diamond	220		Resinoid
	Rough and finish on semi-automatic machine, straight wheel	Silicon-Carbide	80	Soft	Vitrified
	Roughing on semi-automatic machine, cup wheel	Silicon-Carbide	60	Soft	Vitrified
		Diamond	100		Resinoid
	Finishing on semi-automatic machine, cup wheel	Silico -Carbide	90	Soft	Vitrified
		Diamond	220		Resinoid
Milling Cutters, Reamers End Mills, Saws, etc.	Backing-off, roughing, cup wheel	Silicon-Carbide	60 or 80	Soft	Vitrified
		Diamond	100		Resinoid
	Backing-off, finishing, cup wheel	Silicon-Carbide	100	Soft	Vitrified
		Diamond	220		Resinoid
Miscellaneous Operations	Surface Grinding, roughing	Silicon-Carbide	60	Soft	Vitrified
		Diamond	100		Resinoid
	Surface Grinding, finishing	Silicon-Carbide	100	Soft	Vitrified
		Diamond	220 or 320		Resinoid
	Cylindrical Grinding, roughing	Silicon-Carbide	60	Soft	Vitrified
		Diamond	100		Resinoid
	Cylindrical Grinding, finishing	Silicon-Carbide	100	Soft	Vitrified
		Diamond	220		Resinoid
	Internal Grinding	Diamond	100 or 220		Resinoid
	Cutting-off	Diamond	150		Resinoid



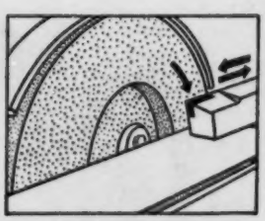
Operation 1—Rough hollow grind the top face of the tool on the periphery of a straight wheel with a crowned surface. Use free-hand cutting only when one or two tools are to be ground



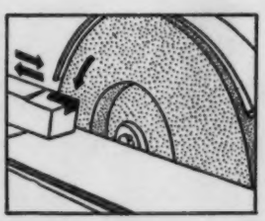
Operation 2—Rough front clearance. Set the table rest at 10 deg. (5 deg. greater than the finish angle desired), and rough grind front clearance leaving about 1/32-in. land at the edge



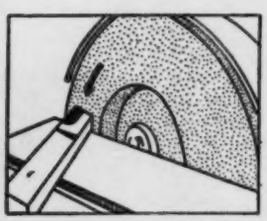
Operation 3—Rough side clearance. Use the same wheel and table angle as in Operation No. 2. The angle at which the table rest is set will vary with the wheel. On the tool it should be about 10 deg.



Operation 4—Semi-finish top face. Use the face of a cupped wheel with 1/32 to 1/16-in. crown surface. With the table rest set at the finish angle desired, semi-finish grind top face of tool



Operation 5—Semi-finish side clearance. Set the table rest at 6 deg. (finish angle desired). Reverse the wheel direction, and on the left-hand face of the wheel semi-finish grind side clearance



Operation 6—Semi-finish front clearance. In this operation also semi-finish grind the radius on the nose of the tool

Operation 7 — Sharpen top face. Set table rests for correct top side rake. Dress a flat surface on the wheels for use on this and the succeeding operations

Operation 8 — Sharpen side clearance. Set table rests at 6 deg. (finished angle). Reverse wheel, and on the left-hand face finish grind side clearance

Operation 9 — Sharpen front clearance. Using the wheel rest as in Operation 8, with the table rest as the same angle, finish grind the front clearance

Operation 10—Sharpen radius. Finish grind radius on the nose of the tool using the same wheel as in Operation 9 with the table rest set at the same angle

num and monel metal. Most tools can be commercially finished to the required smoothness without lapping.

Lapping is in order for close-limit precision boring tools and can be done on a Belgian iron or vanadium cast iron lapping disk impregnated with No. 4 diamond powder moistened slightly with olive oil.

EDGE RADIUS

The cutting edge is rounded off for most steel materials whether cast, forged or rolled, heat-treated or annealed, principally to strengthen the edge to resist different cutting conditions at various depth in the chip. This is done with a radius on the forward portion of the cutting edge and nose to suit the structure of the material below the scale, and with a slightly larger radius where scale might cut a ridge in the carbide. Good practice is to use a complete radius of 0.002–0.003 in. for the zone at the tip, and a radius of 0.005–0.008 in. for the zone away from the tip. In general, the top side rake for steel is about 8 deg., but this may be increased or decreased as conditions demand. Another method is to use 0.015-in. radius at the tip, a 0.030-in. radius away from the tip and a top side rake of 3 deg.

Probably three-fourths of the failures of cemented-carbide tools can be traced to faulty grinding. If minute checks are visible under a ten-power glass, grinding has been done too fast, if done dry; or without enough coolant if done wet and very likely with too hard a wheel. The various grades of carbides vary widely

in grindability, which is not a function of their hardness. Grinding cracks can seldom be ground out.

TOOL GRINDING PROCEDURE

Recommended practice is to dress the grinding wheel with a slight crown. On straight wheels for rough grinding, the periphery is dressed to the crown of $\frac{1}{16}$ in. On cup wheels, for roughing, the face of the wheel is dressed to a crown of about $\frac{1}{16}$ in., and on cup wheels for semi-finishing the face of the wheel is similarly dressed. For finish grinding or sharpening, the cup wheel is dressed flat with a diamond impregnated dresser. Dressing the wheels with a slight crown greatly reduces the area of contact of the tool against the wheel and helps keep to a minimum the amount of localized heat generated.

Alternate grinding on the carbide tip and the steel shank represents a simple method of hogging off large amounts of stock rapidly, without injury to the tip. By use of this procedure it is unnecessary to dress the wheel, except to reshape the crown when worn.

To prevent excessive localized heat in the tip, it is important that the tool be kept constantly in motion while grinding. Keep the tool slowly but continuously moving back and forth across the entire surface of the wheel. This movement should be maintained at all times, whether roughing, semi-finishing or finishing. A second movement to obtain rapid stock removal consists of rocking the tool. This is recommended only while roughing and semi-finishing, not while finish grinding.

Exert moderate, not heavy, pressure while roughing, and light pressure while semi-finishing and sharpening.

MACHINE LAPPING

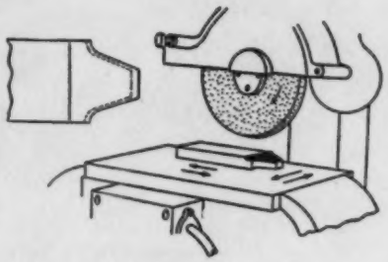
In lapping carbide tools set the table of the lapping machine $\frac{1}{2}$ deg. less than that used for the grind. This will develop the cutting edge and make operation faster than when lapping the entire surface of the tool. Use diamond dust sparingly because the disk is impregnated and diamond dust is expensive.

Work should be examined frequently under at least a 10-power magnifying glass to determine the keenness of the cutting edge.

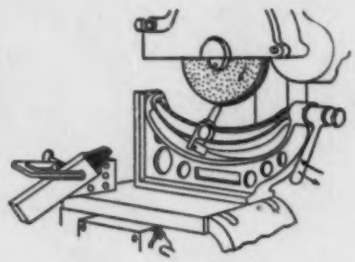
The direction of rotation of the disk should be against the cutting edge of the tool.

Lapping should continue until all grinding marks are removed.

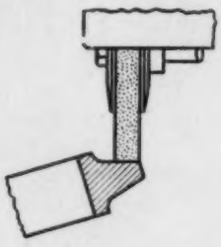
STRAIGHT SHANK FORM TOOLS



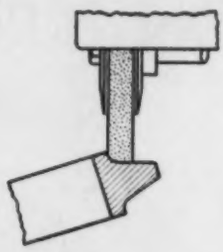
Set up tools on magnetic chucks or in a vise and surface grind the top. This set-up may also be used for sharpening



Set up the tool and dressing attachment on the grinder table. First true the wheel square



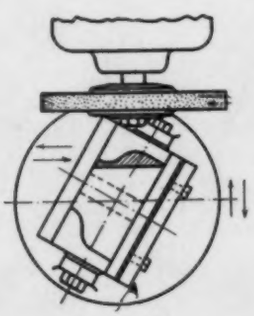
Set up the tool in a vise and grind the straight side, passing the wheel across the work



True the wheel to the correct radius or contour and grind first on one side and then on the other

True the wheel and grind the nose. This assumes a straight cutting edge on the nose of the tool

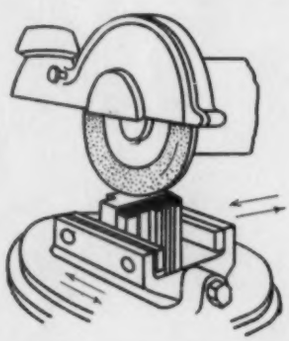
To secure the desired shape, alternately dress and grind until the correct shape is produced. Usually only a few passes can be taken with the wheel before it requires redressing. The use of sectional templets is advocated during the course of grinding as a rough check on the work, but if possible the projection method should be used for final inspection



CIRCULAR FORM TOOLS

Circular form tools should be set up in a vise so that the correct angle will be produced. Grind, passing the work under the wheel and feeding the wheel downward slowly

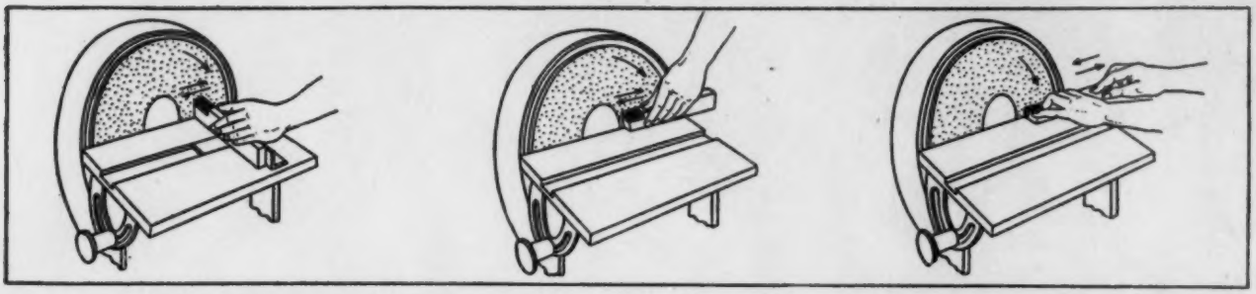
Like flat form tools, circular form tools are resharpened by grinding on the top of the tooth without disturbing the form ground on the periphery of the tool by the manufacturer. A surface grinder or a tool grinder, using a plain wheel is recommended. Cup wheels are not advocated because of their slow cutting action and tendency to generate heat



DOVETAIL FORM TOOLS

Set the tool up in a vise so that the correct angle will be produced on the work. Grind with a down feed of 0.001-0.002 in. per pass for roughing and 0.00025-0.0005 in. per pass for finishing. Use a cross feed of 1/16 in. and a table traverse of 30-35 in. per min

Dovetail form tools require grinding only on the ends. Free-hand grinding is not recommended because of the large area of carbide and the danger of cracking the tip of an expensive tool. Surface grinding on the periphery of a wheel, either on a surface grinder or on a cutter grinder is satisfactory

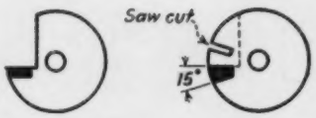


Lap the nose by holding the tool against the disk, keeping it in motion. Place a small quantity of diamond dust and olive oil on the tool in position

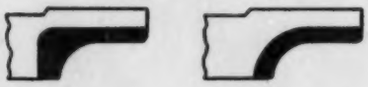
Lap both sides of the tool still keeping it in continuous motion to avoid localized generation of heat. Wheel motion should always be down from tip

The top should then be lapped with the table set at the correct angle, following the general procedure outlined for the nose and side

COMMON ERRORS IN TOOL DESIGN

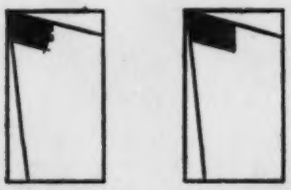


1. The circular form tool at the left is unsatisfactory because as it is reground the tip will become progressively thinner at the cutting end while maintaining most of its original thickness at the inner end. This would not occur in the case of a homogenous cutter. The design at the right has two striking advantages. The formed blank is left solid except for the milled recess for the tip and the saw cut shown. The tip is brazed in place. The saw cut helps to break up any possible closed stress circles or hoop tension resulting from the brazin operation. The good support given both sides of the tip by the steel shank permits rapid grinding to the desired form. The tool is then gashed as shown by the dotted line.



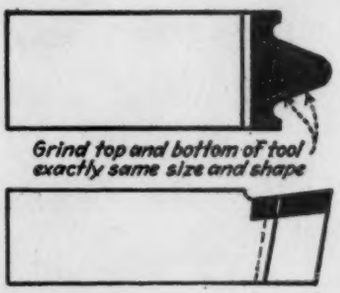
2. The flat forming tool at the left used for brass journal cracked repeatedly, at the point indicated, despite precautions. Redesign at the right gave a satisfactory tool because it avoids abrupt changes in the cross-section of the carbide. In applying carbides to cutting tools the widely differing coefficients of thermal expansion of the carbide and steel used for the shanks puts definite limitations on tip and shank shapes and proportions. At brazing temperatures the steel shank is distended. Once the braze becomes solid further contraction of the shank can take place only at the expense of setting up stresses either in the carbide or in the braze.

3. Tips which extend $\frac{1}{16}$ to $\frac{1}{8}$ in. of the edge of the tool should be avoided as the thin section of steel will warp during cooling from the brazing temperature and pull away from the tip causing either a poor braze or a cracked tip. Where working conditions, such as limited space in tool set-ups, demand such a thin section, it is far better to extend the tip entirely across the shank. If positive resistance to movement, caused by side stress, seems necessary, it is better to use a half round or bead key as shown at the right. The dotted line shows that this method of anchoring a tip can be applied to round as well as square nosed tools.



4. An important consideration is the shape of the milled recess in the shank which receives the tip. For tools having deep side rakes the use of a rectangular blank, shown at the left in solid lines, results in a tip having inadequate width of contact with its supporting shank. While the tip and dotted lines has a broad base upon which to rest, the tool must be scraped when considerable carbide still remains. At the right is shown a properly designed tool incorporating a blank dovetailed at approximately the side rake angle. The dovetail operates to avoid any possibility of the tip being rotated out of its socket by a momentarily excessive cut.

5. The two common forms of roughing tools illustrated have the same cutting edge contour. Inasmuch as proper grinding procedure indicates that when dulled tools are reground, some of the stock should be taken off the end, the side and the top, the tip becomes progressively shorter, narrower and thinner. The design at the right is similar to that of the left, because the tip width will remain almost constant throughout the tool life.

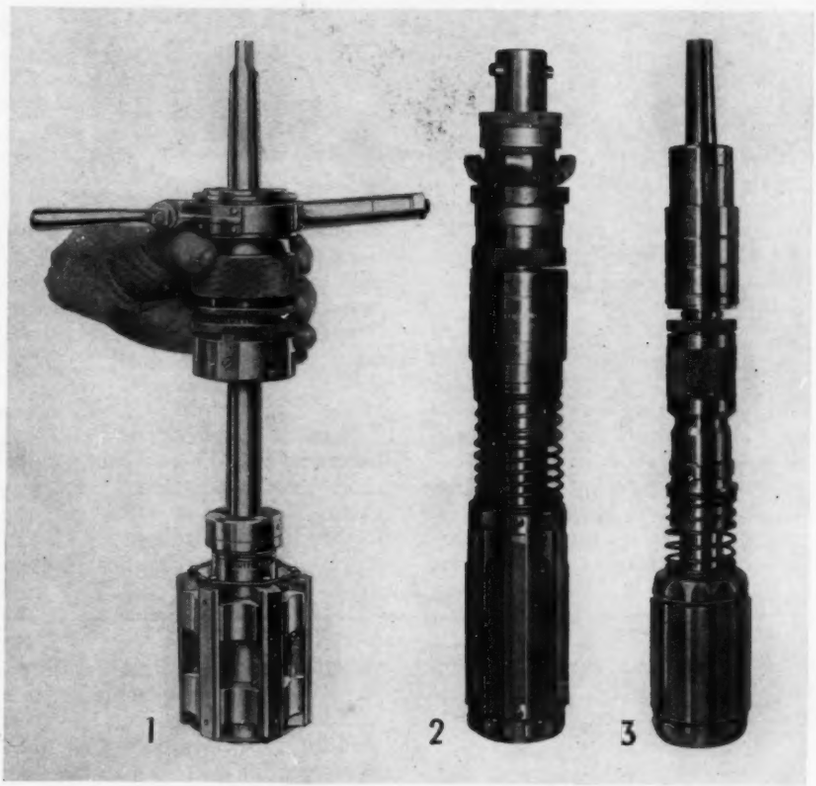


6. The design illustrated is recommended for flat forming tools. Because of the way in which this tool is ground, successive regrinds parallel to the original surface will not cause the form of the cutting edge to lose size, a fault to which flat forming tools of other designs may be subject.

The Hone's Zone

Some practical applications in gasoline and diesel engine manufacture show logical uses for this method of fine finishing

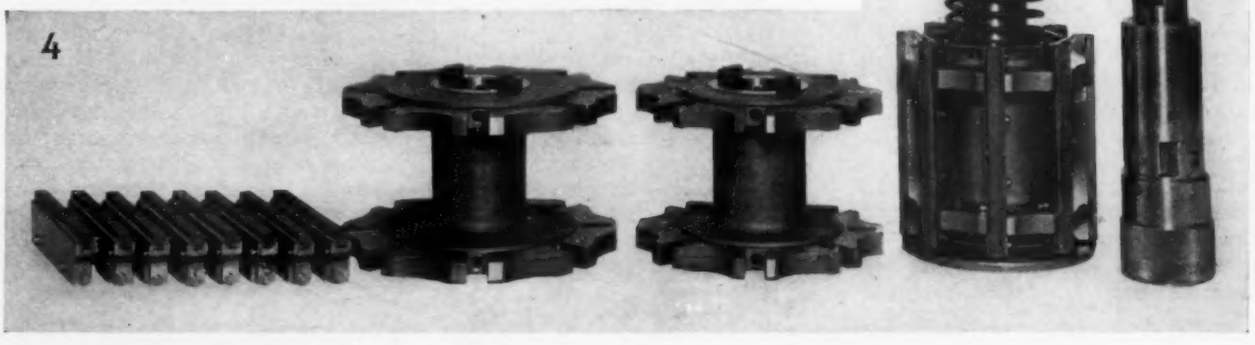
By KIRKE W. CONNOR
President, Micromatic Hone Corporation



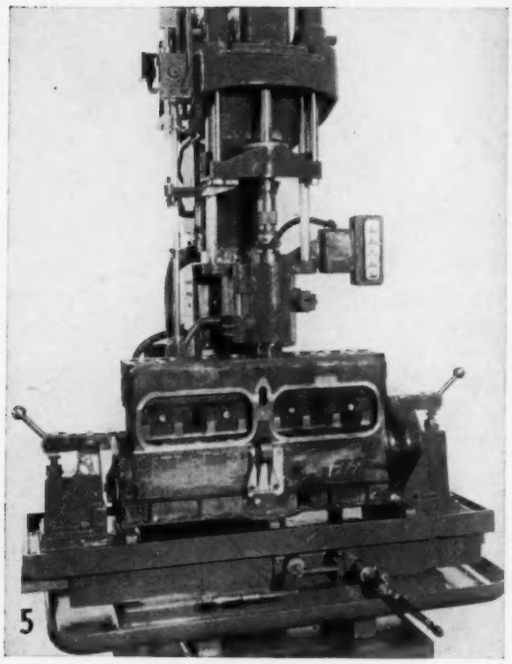
1-3 Honing stones are held in the automatic, mechanically actuated tool at left; the semi-automatic, mechanically actuated tool at center; or the hydraulically operated type tool shown on right

HONING IS fundamentally a wet cutting process which, at its present stage of development, comprises various methods of controlled, mechanical application of bonded abrasive on the internal surfaces of cylinder bores and on the external surfaces of cylindrical parts. It accomplishes four things: it removes substantial amounts of stock, generates size, generates accuracy for roundness and straightness, and produces a desired degree of surface smoothness. It does not conventionally generate alignment as related to squareness, concentricity or parallelism of axes in adjacent bores.

The number of abrasive "sticks"



4 Developed for heavy duty applications this typical semi-automatic mechanically actuated tool has interchangeable units to give desired range



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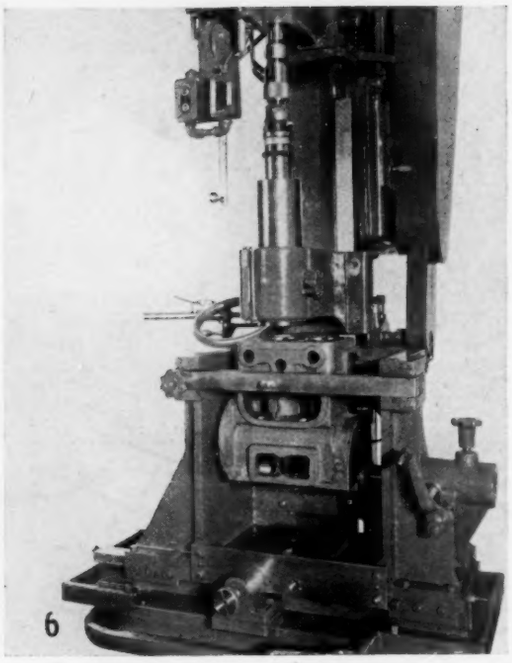

6

5 Automatic, mechanically actuated tools guided in a combination type bushing mounted in a bracket on the column of the honing machine are used on the straight 8-cylinder block shown in this lateral indexing, 8-station fixture. Following reaming or finish boring, approximately 0.003 to 0.0035 in. of stock is removed in a rough honing operation. This is usually followed by secondary finish honing operation in which 0.005 to 0.007 in. of stock is removed producing uniform diameter size and accuracy for roundness and straightness within 0.005 to 0.007 in.

6 This installation for honing twin-cylinder tractor blocks with semi-automatic, mechanically actuated tooling in a rough honing operation is typical of many single spindle machine installations. The work is held in a special, front loading, lateral indexing, fixture. Crank at right of the fixture controls locating plunger which enters crankshaft bore in block. The same fixture and machine can be arranged for finish honing by using an automatic type tool in connection with a combination actuating and guiding bushing mounted on the machine.

7 Two approximate locators in the base of this fixture are raised or lowered by pushing or pulling the short lever at the front of the machine. In the neutral position, the locators are clear and the block can move in either direction. When

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used in conventional honing tools may be varied, as may their widths, lengths and thicknesses. They are arranged to assure even pressure distribution, and the tool is self-centered in the bore at all times. This arrangement permits the varying of the number of cutting tips so that, with either low or relatively high total pressure, low unit pressures and the elimination of injurious frictional heat are possible.

Uniformly controlled cutting action is obtained by a multi-directional travel path of the sticks, in various combinations of rotation and traverse or reciprocation. Where desirable, the work also may be rotated or reciprocated or both, in addition to the actuation of the honing tool.

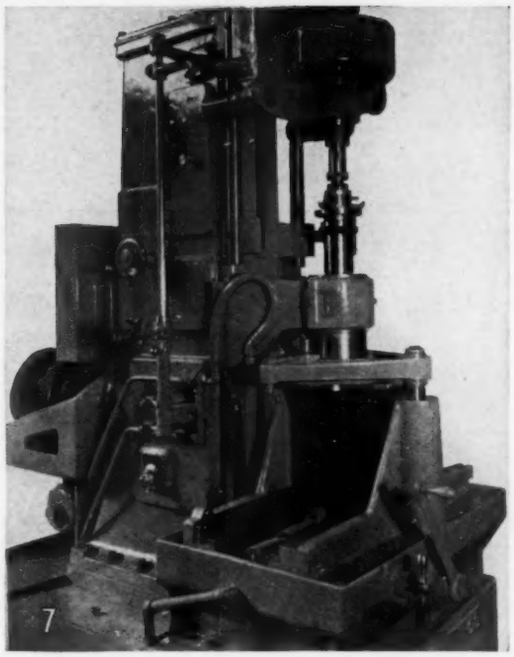
When a number of these sticks are positioned at spaced intervals around the periphery of the hone, the paths of all the sticks during operation will cross each other many times. With the selection possible in number of sticks and of motion, a wide range of selection in establishing the angle of crosshatch is possible.

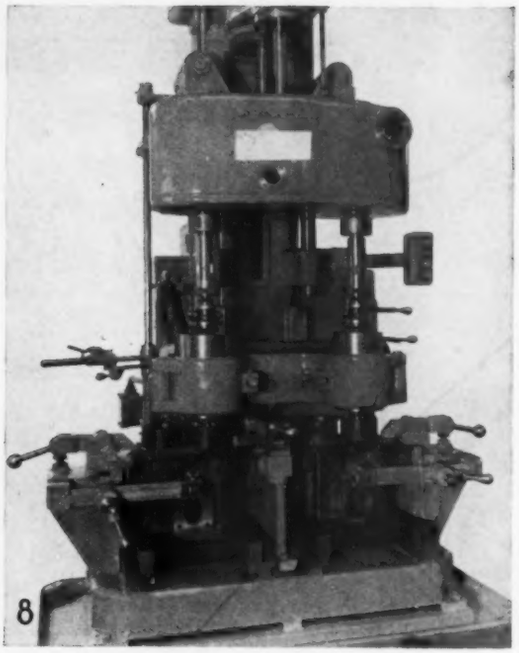
Depending upon the amount of stock to be removed and the final surface finish desired, the surface speeds in the honing process may range from 10 to 250 ft. per min.

Accuracy for roundness is generated by the rotary motion of the hone and the controlled, positive expansion provided in the tool. Accuracy for diametric straightness is generated by the reciprocation, or reversing traverse of the hone which permits the correction of error of taper. Accuracy for axial straightness is accomplished by the use of sufficiently long stones to overcome any "snakiness" which has been generated in the bore in the previous operations.

The desired degree of surface smoothness is controlled by adjustment of the cutting action of the abrasive. There are several ways of reducing the penetration of the grits to accomplish this. Where the coolest, free-cutting action is desirable, it is customary to reduce the pressure while either slightly reducing or maintaining the speed. With this method the cutting action may be so controlled that the viscosity of the coolant or lubricant may support the abrasive in a "sparking out" action. If a low degree of heat in cutting action is not unfavorable, it is also possible to obtain smoothness by maintaining the pressure used for stock removal while increasing the speed sufficiently to prevent penetration of the grits into the metal. The former method is preferable for the elimination of minor deformation in the surface.

The stones may be held in several types of tools as shown. The auto-



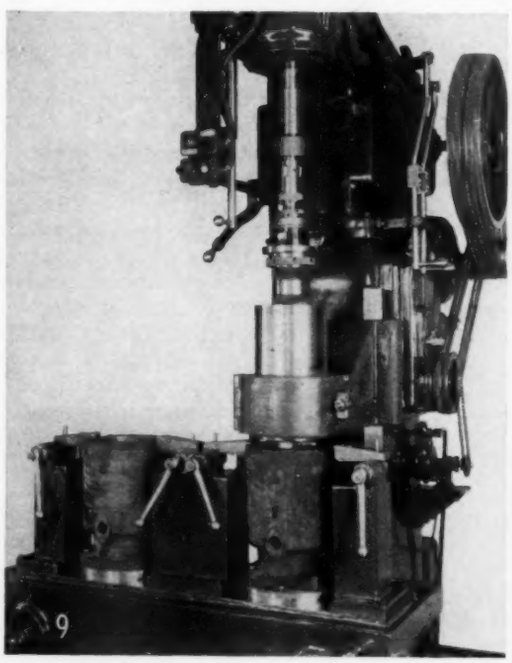


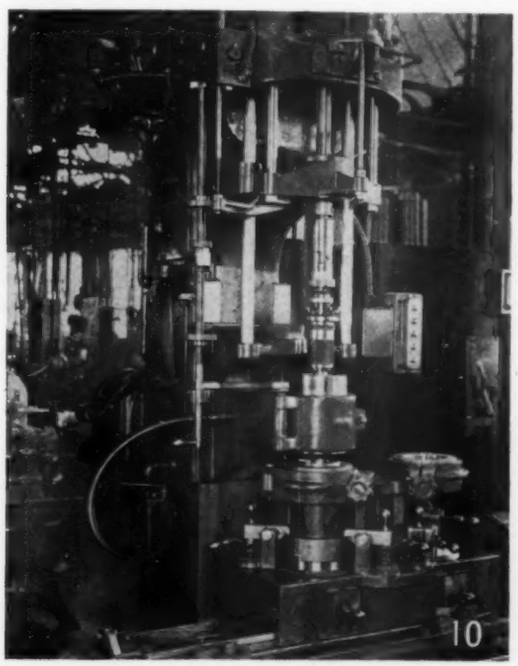
loading the fixture, the desired approximate locator is raised and block is slid against it. The long lever lowers the combined bushing plate and clamp which contains the locating dowels and securely locks the block in place for honing. A mechanically actuated, automatic type hone is used in the 6¾ in. diameter bore of this duplex tractor cylinder block

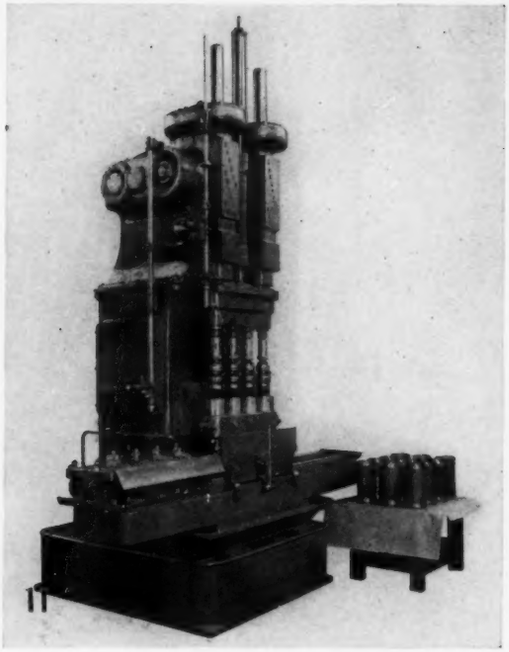
8 Two-cylinder blocks having bore sizes of 4¼ in. and 5½ in. respectively are held in this locating fixture by simple clamps. Auxiliary spindles of the two-spindle head are driven from the fluid motor in the top of the machine. Machine indexes after the first operation.

9 The loading fixture with two stations is mounted on ball bearings which travel on hardened steel bars in the base member so that the work holding section may be easily moved from one position to the other. The equipment shown here is used for honing tractor cylinders 6¼ in. in diameter by 14.8 in. long. The bore is honed in two operations, requiring approximately one minute floor to floor time for either the rough honing or the finish honing operation

10 Special lateral indexing, work-holding fixture shown here is used for honing replaceable sleeve liners on a single spindle machine with automatic, mechanically actuated honing tools. Honing of truck and tractor cast iron or alloy sleeves usually follows a finish boring or grinding operation which generates the alignment at concentricity, but which requires from 0.003 to 0.0045 in. of stock removal for cleanup







11 Replaceable sleeves, are dropped into this rolling type two-position fixture arranged for honing four 4¾ in. diameter by 11¾ in. long diesel tractor sleeves at a time. Coolant is fed to the hollow bracket which holds the hone bushing. Drilled orifices in the bushing take the oil directly to the hones in the work eliminating splash

12 Semi-automatic, mechanically-actuated tools of the interchangeable spool type are used on what at present is one of the tallest honing machines ever made for honing a wide range of diesel cylinders. Set up for honing 17½ in. diameter by 60 in. long cast iron diesel cylinder liner. Approximately 0.0007 in. to 0.001 in. stock is removed per minute following boring within an accuracy of 0.001 in. for roundness and straightness.

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matic type, mechanically actuated tool is favored by many users because it does not require constant attention by the operator to maintain the pressure cycle which permits more time for loading, unloading or checking the work. A semi-automatic, mechanically actuated tool is used where lower production requirements exist. It is also used for rough-honing, while automatic tooling is used for finish-honing operations. The hydraulically operated honing tool can be effectively used in the applications described below.

A typical semi-automatic, mechanically actuated tool has been developed for heavy-duty general purpose applications. Interchangeable flange units, or spools, are provided, instead of the conventional complete body assembly, which provides a maximum expansion with a minimum of equipment and tool investment. Three sets of stone holders are re-used in all of the interchangeable spools to reach the desired range of diameter variations.

Production requirements, of course, determine the type of honing machine and the type of fixture to be used. Illustrations on these pages indicate some of the methods used on cylinder blocks, replaceable liners and diesel engine bores.

Truck and tractor cast iron or alloy sleeves are honed after a finish boring or grinding operation which has generated the necessary alignment and concentricity, but which requires from 0.003 to 0.0045 in. of stock removal for clean up.

Equipment shown in the illustrations is typical of that which has been adopted by several manufacturers of replaceable sleeves. These installations show the use of automatic, mechanically actuated honing tools with special lateral indexing, work-holding fixtures to meet production requirements of manufacturers specializing in the supply of replaceable sleeves.

The application of honing in diesel engine manufacture includes both smaller engine blocks as well as the larger diameter cylinder sleeves. Other large diameter applications include air compressor cylinders, railroad cross-compound cylinders, locomotive side and main rods, diesel connecting rods and other parts.

Boring or grinding is commonly employed as the final alignment generating process prior to honing in larger diameter sleeves. (Both boring and reaming are used in smaller diameter engine cylinder blocks.) Approximately 0.005 to 0.007 in. of stock is left following the boring of larger diameter work. From 0.001 to 0.0015 in. is left for clean-up following grinding operations and approximately 0.0035 in. is left for clean-up following reaming operations.

Cast iron alloy sleeves, 8 in. in diameter, 197 to 235 Brinell hardness, are being honed in regular production by two diesel manufacturing plants. Approximately 0.007 to 0.009 in. of stock is removed in two honing operations which follow a boring operation and heat-treatment. This is followed by a third operation which has been developed for honing an accurate relief section, approximately 0.009 to 0.010 in. in maximum depth on a side and approximately 4 in. in length. This arc relief is generated in the bore wall by inserting specially formed cutting tools into the honing tool stone holders. Following the generation of this section, it is honed by exchanging the cutting tools for abrasive stones.

Press Broaching

Sturdy broaches adequately supported plus effective work clamps permit cuts that would require several operations by other methods

By C. W. HINMAN
Tool Engineer
Kobzy Tool & Electric Mfg. Company

IN GENERAL, broaching dies are used for cutting shapes in light and medium heavy parts, but there is no reason why they cannot be employed in heavy operations given the correct punch speed and the necessary travel of the press slide. Deep broaching operations, in quantity production and for parts too large for power presses, are fabricated in broaching machines in which a long broaching cutter is ordinarily pulled through the work.

Broaching dies are particularly useful in operations on thick blanks, for internal cuts through forgings and castings, and for external cuts in either the sides or at the ends of commercial sections. Internal broaching is used for enlarging round holes or for changing them to other shapes.

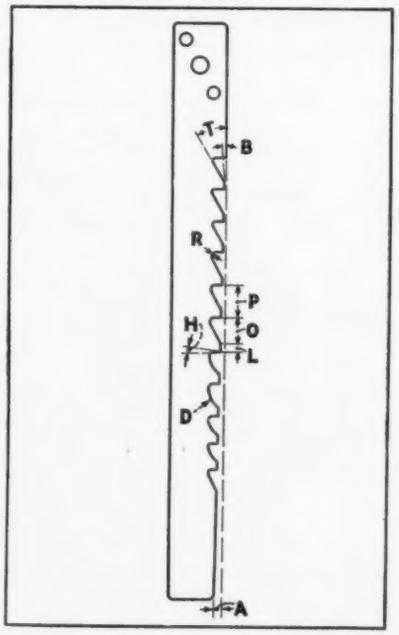


Fig. 81—In a press broaching tool, it is best to make the first three or four teeth closer than pitch P, so that they act as leaders

In broaching dies, the work must be rigidly clamped in opposition to the cut, and all the working members of the die, especially the broaching punches, must be of sturdy construction. The broaches should be well supported and guided in order to resist excessive wear and breakage. The die set should have precision-fitted guide posts of comparatively large diameters; a "staggered post" type of die set equipped for broaching in a straight-side press is the ideal set-up.

Broaching cuts are governed by the same restrictions as are found in all other machine cutting operations; namely, to attain the maximum speed of the cutting tool, in feet per minute, without its showing excessive wear or failure; the disposal of chips; use of proper lubrication; the effect of certain tooth shapes; and the maximum feeding distance into the work that the teeth can safely take per cut.

For certain external cuts, broaching is considerably faster and less expensive than milling. For example, it is a simple operation to broach several straddle cuts in a single-operation die, on the opposite edges of work, and at given distances from the ends of long pieces. To mill the same cuts, several operations would be necessary unless an expensive and complicated fixture were used.

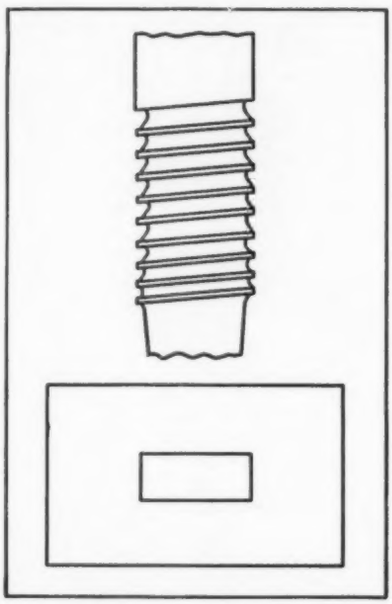


Fig. 82—Teeth on a broach for enlarging a square or rectangular hole should be slanted in opposite directions on opposite sides to provide a shear cut and to avoid side thrust

An example of internal broaching is in cutting a key-way along a finished hole through a hub. The broach, in descent, "pilots" through the hole in the hub, and the teeth do not begin to cut until the pilot end has fully entered a fixed guide bushing beneath the work. A clearance slot is provided within the wall of the bushing coincident with the line of travel of the broach.

For external cuts, broaches are designed with comparatively heavy backing heels. The heels are supported and guided on three sides

by long slots cut in guiding blocks which are rigidly attached to the surface of the die or shoe. Guiding slots are lined with hardened, ground and lapped plates to insure long wear. The guides are attached opposite the cuts. Guiding should start above the cut and continue down to the surface of the die shoe and beyond if necessary. Only the cutting edge of the broach is exposed, plus a small clearance, which together provide sufficient depth to suit the operation.

The cutting principle governing the operation of broaching punches, the tooth shape and chip clearance, is closely related to those of formed milling cutters. The travel of a broaching punch should not exceed 40 ft. per min. in ferrous metals. An emulsion cutting compound is used for steel forgings and cast iron, to obtain free cuts and smooth finishes. Some grades of steel forgings may require a lubricant of animal oil for heavy cuts. Brass can be cut up to 80 ft. per min., or higher, for light operations of regular contours. Cutting speeds employed in hydraulically driven broaching machines seldom exceed 40 ft. per min.

These data indicate that a power press, which has been speeded for ordinary piercing and blanking dies, has a slide travel that is about right for broaching. A press slide that runs at 120 strokes per minute and driven by a $1\frac{1}{2}$ in. crank-throw, has an average descent of 30 ft. per min. For presses that run at higher speeds, it is advisable to reduce the number of strokes per minute for heavy broaching operations.

Designing the Teeth

The usual shapes for broaching teeth are shown enlarged in Fig. 81. The pitch P, or the distance from tooth to tooth, is determined by the formula $0.35\sqrt{C}$, in which C is the length of the cut. However, it is best to decrease the constant 0.35 to 0.20 when cutting distances less than $\frac{1}{2}$ in., so that two or more teeth will be cutting at the same time.

The "land" L, which is about 1/5 P, is slightly "backed off" as indicated by angle B; this angle may vary from zero to $\frac{1}{4}$ deg. The pitch can be decreased to suit unusually hard or difficult work, or for abnormally long and wide cuts. The tooth angle T, which is normally 30 deg. is sometimes decreased to avoid weakening the cross-section in very small broaches.

Fillet R, at the root of the teeth, is made as large as chip space will permit. Chip clearance may be increased by using an arc connection as shown at D, instead of a straight line connection between the teeth. The last three or four teeth at the top are straight in line for accurately finishing the cut. A rake angle H, of 5 to 7 deg., can be specified in all the teeth; this design favors curling the chip and tends to decrease the pressure required to operate the broach.

The feed from tooth to tooth is determined by the cutting resistance of the work material the same as it is for cuts in other power-driven machines. It depends largely on the hardness or toughness of the material and the quality of finish desired. The feed is controlled by the acuteness of angle A; this angle can be slightly altered, if necessary after the broach has been hardened, by changing the angle in grinding. Tooth opening O, is approximately equal to: Depth of the tooth/tan T, and the feed per tooth is equal to tan $A \times P$.

Scope of Die Broaching

For broaching square and rectangular holes, the usual design of the broaching cutter is seen in Fig. 82. The cutting teeth are slanted across the face of the tool at an angle of about 5 deg. The angular slant of the teeth causes them to shear-cut the chip. This feature gives a smoother finish than straight-across teeth; it also reduces pressure on the teeth. Shearing angles are in opposite directions on opposite sides of the broach, which balances the cut and leads the tool straight. Broaching punches of this type are usually pushed entirely through the work and die holder and then returned by hand for making the next cut.

It has been said that the operation of die broaching is simply a series of multiple shaving punches of increasing sizes passing through the work. This is an interesting comparison inasmuch as it directs attention to the surprising similarity in different kinds of cutting operations.

The variety of shapes that can be broached are limited only by the skill of the designer and tool maker in producing a tool blank of the proper length, taper and cross-section, and in providing it with the most efficient number and shapes of teeth, and lastly by the ingenuity of the tool hardener. A broach which has warped in hardening can sometimes be straightened while the temper is being drawn.

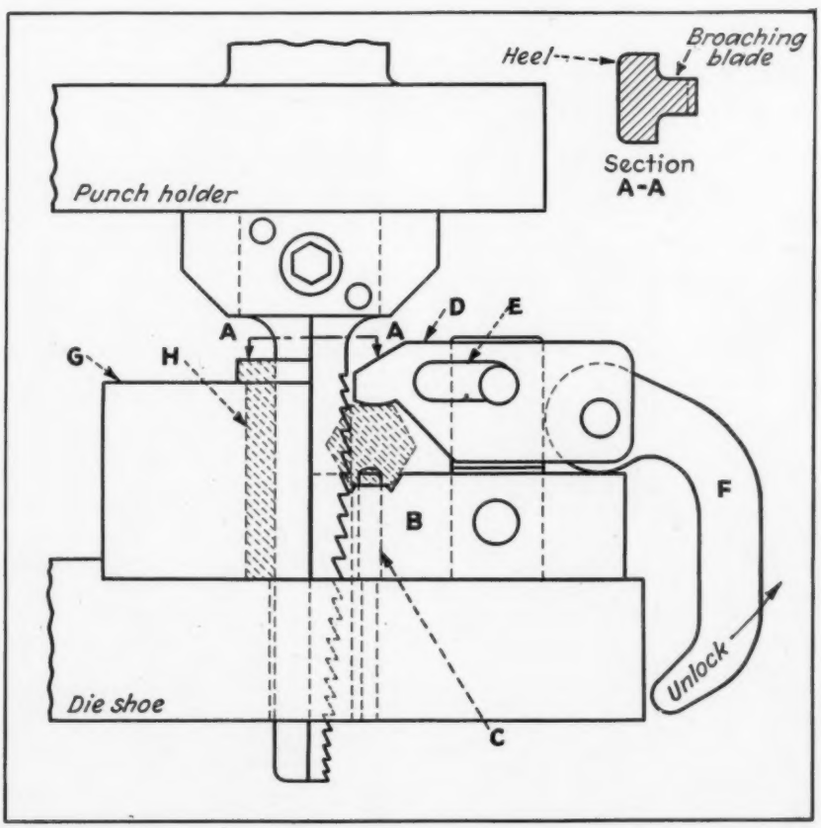


Fig. 83—Clamp D *prevents the work from turning with the cut, and is released with a one-hand movement of handle* F

Broaches are commonly used for these shapes: Round, oval, square, rectangular, regular or irregular polygons and for combinations of these shapes. Key-ways, splines, and small internal gears are well-known examples of broaching. Internal helical grooves can also be broached by allowing the broach to revolve while following through the lead of a long spiral. Broaching is a "straightaway" cut; it is a cut easily controlled by the length of the broach, by the depth of the feed per tooth, and by the number and shapes of teeth. It is possible to broach a large variety of external contours for small slots such as half-hexagonal and U-sections; this can be done on a production basis more rapidly in a die than by milling with a profiling cutter. Pads and bosses on castings can also be broach finished.

External Broaching

Foregoing references to the sturdy design necessary in all the parts of broaching dies are exemplified in Fig. 83, which shows a job of external broaching. The work to be broached is a short hexagonal section of cold-drawn steel, ½ in. across flats, and is "nested" in the die block *B*, endwise between gage pins *C*. The operation consists in one external broaching cut. Additional opposite cuts, or end cuts, could all be made at the same time if necessary. For an external cut on one side of round stock, great clamping pressure is essential, otherwise the piece will revolve with the down stroke of the broach. In such cases, a pair of clamping jaws are necessary, and the moving jaw should equalize when closing upon the work. A clearance slot for the cutter is, of course, necessary down through the stationary jaw. In opposite cuts where the cutting pressures balance on the work, heavy clamping is not so vital.

As shown, clamp *D* prevents the work from turning with the cut. The clamping point is located close to the operation. The clamp is unlocked and pulled back through slot *E*, for removing finished pieces and to reload the tool. Cam handle *F* is used to release or to lock the clamp, and this can be done, either way, by a one-hand movement.

A simple device may be installed, in tools of this character, to eject the finished pieces automatically. A spring plunger is arranged to bear against one end of the piece, and with a positive stop pin at the opposite end. The work is "snapped" between them when loading. After the cutting operation, the clamp is pulled away, and by simply depressing a lever that protrudes in front of the die, an ejector pin is caused to contact under the work near the stop pin. This action lifts the work above the stop, and the spring plunger instantly throws the piece endwise out of the die.

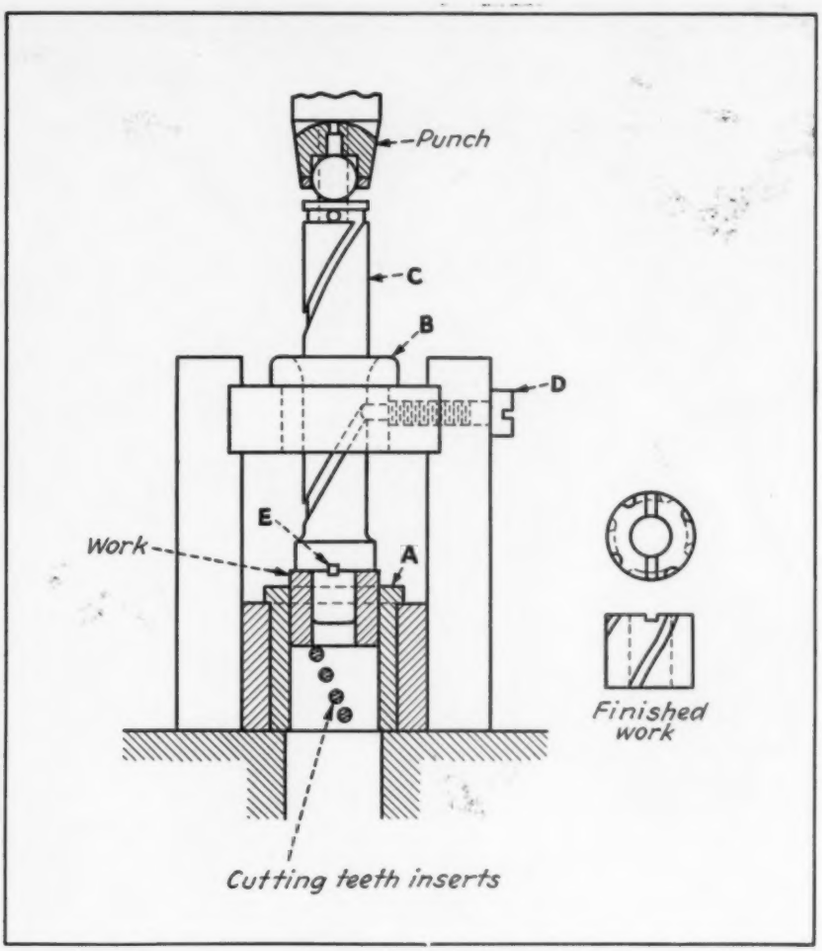


Fig. 84—Plunger C moves downward in a helical path and its key E engages the work to drive it in a similar path while inserted broach teeth in bushing A cut helical oil grooves in the outer surface

The tapered cutting edge on the broaching blade is exaggerated to show it clearly. Block *G*, with its wear casing *H*, "backs up" the heel around the broach. The blade and heel are one piece of cutting steel as shown in section *A—A*. The T-section of the broach strengthens the blade greatly, it prevents distortion in heat-treating and hardening, provides a larger guiding surface, and maintains cutting precision and long wear. The die set used is one of the long, narrow "staggered post" types.

External Spiral Grooves

A principle often used for die broaching exterior spiral grooves on the surfaces of bushings, or on any short lengths of cylindrical work, is shown in Fig. 84. The broaching teeth are inserted through holes within bushing *A*. Bushing *B* is a guide for the spiral-grooved plunger *C*. The spiral leads in *A* and *C* correspond. A point on screw *D* is engaged in the spiral groove and causes the plunger to revolve when it is advanced by the punch. The punch has a retained steel ball that bears on the end of the plunger and reduces the pressure friction between them in descent.

The work is placed within bushing *A* when the plunger and punch are up. In descent, the punch causes the key *E*, at the end of the plunger, to engage in a previously broached slot across the work. This arrangement causes the work to revolve with *C* in descent, while cutting through *A*, until the work is pushed out finished beneath the press.

The plunger ascends with the punch because of an attachment shown between them in the groove around the top of *C*. This is a fast operation for cutting oil grooves in duplicate parts.

Leveling blocks greatly facilitate the work of getting ways true horizontally

Lateral alignment of the bed is checked by means of a taut wire and a pedestal type "mike"

On the Level

By JOHN HAYDOCK
Managing Editor, American Machinist

FEW THINGS in life are reliable unless they are on the level. This is especially true of a planer. Skilled operators may try to spring a piece of work in an attempt to offset bends and winds in the planer bed, but by and large, it is seldom possible to maintain work coming off the machine at a higher level of accuracy than the machine itself.

A new machine may come into the shop lined up within a thousandth of an inch; but any casting as long as a planer bed is sure to take the shape of its foundation. Loading and unloading operations, vibration and sinking of the soil tend, in the course of time, to destroy the original alignment.

Good practice now dictates that a planer be set on an approved type of leveling blocks. But whether these blocks or the old-fashioned shims and wedges are used, periodic inspection and realignment are essential for accurate work. Systematic care of a planer pays a double dividend; it saves time in assembly and improves the quality of the product.

There are a number of ways of tackling the job of realignment, but the important thing is to know one good way and to use it systematically. The following procedure is recommended by William Sellers & Company, Inc.:

1. Remove the table.

After one way is aligned the other can be brought parallel to it

2. Align the bed laterally from end to end using a piano wire or Cuttyhunk fish line (braided silk line tends to flatten when stretched). The wire or line is held on parallel pedestals or notched wooden blocks, a short distance away from the side of the bed. With the wire taut, readings are taken along its length with a pedestal type micrometer held against a special adapter which is mounted on one of the V-blocks. Any bow in the bed can be detected and removed by jacking laterally against the ends or center.

3. Fit gage blocks to the ways. These blocks may be made in the shop or obtained from the machine builder. If the ways are identical (such as two V's) two blocks are sufficient. If the ways are different, two blocks for each will be needed.

4. Using a straight-edge and level, check the center section first. Greater weight and more work at this point make it most vulnerable to settling. A precision level indicating 0.0005 in. per graduation should be used. The straight edge must be of rigid design and made from well seasoned material; it should be frequently checked for trueness. Four points should be levelled; fore and aft, and across. Bring the low points up to the higher ones with levelling blocks or wedges.

5. From the center, level along one way first toward the front end of the bed, then toward the back. If the planer has been installed correctly the hold-down bolts (when used), will be over the points of support. These are also the points at which the gage blocks should be placed.

6. Still using the gage blocks and the level, check the second way against the one already leveled using the straight-edge across the bed at each point of support. This will bring both ways in alignment.

7. If the machine is badly out of line, a recheck is always advisable. For example, if it is evident at the outset that the machine level is bad, it is best to give the bed a rough leveling before bringing it into lateral alignment. In any case, if any considerable adjustment is made, there is always the likelihood that subsequent corrections will alter the ones previously made. In rechecking it is a good idea to take diagonal readings across points of support as well as longitudinal and lateral leveling. If the bed is so badly out that it has a permanent twist it will be necessary to pull it down with the hold-down bolts.

8. Clean out oil pockets and spools if they are used in order to provide clean lubrication. If automatic lubrication is used, make sure that the filter and strainers are clean and that the oil supply reservoir is filled with fresh oil.

9. All bolts should be tightened, especially those holding the housings to the bed. It is essential that the machine be rigid if the newly acquired alignment is to be retained.

10. Relign the crossrail with the bed. This can be done by putting a straight-edge across the gage blocks in the bed ways and an indicator in one of the tool heads. Traversing the head across the rail with the indicator in contact with the straight edge will show up any misalignment.

11. Check the table on the bed using red lead to indicate the bearing. Usually the table wears hollow due to the peening action produced by driving stop bolts in the top. In such cases, the ends of the ways will have to be scraped to restore the bearing. This is particularly true of the old single section tables. The new box forms tend to hold alignment much better.

12. Take a cut off the top of the table, using a wide nosed tool and a light scraping cut. This operation will make the table top align with the crossrail which has previously been checked against the bed ways.

13. Rail heads and side heads should be checked to see that they are thoroughly rigid. Gibs should be taken up and shoes made snug in the heads but not so tight as to interfere with their motion.

14. By putting a square on top of the table and an indicator in the side heads the squareness of these members may be checked with the machine. Another test is to use an extension bar and check one side head against the other.

Simple Rules Give Better Tools

Too often overlooked, these suggested fundamentals of tool design mean much to the man who uses the tool in the shop

By C. COLE

ALL TOOL designers should be in close contact with the toolroom and the shop, especially the latter. They should be familiar with the problems of the toolmaker and with the difficulties experienced by machine operators when clamps are in the wrong position, hand knobs are too large or too small, and space is not provided for chips to fall away from locating surfaces nor for easily inserting or removing the piece from the jig or fixture. In supervising the design of such tools, far too many designers overlook many important, but very simple, fundamentals of good tool design.

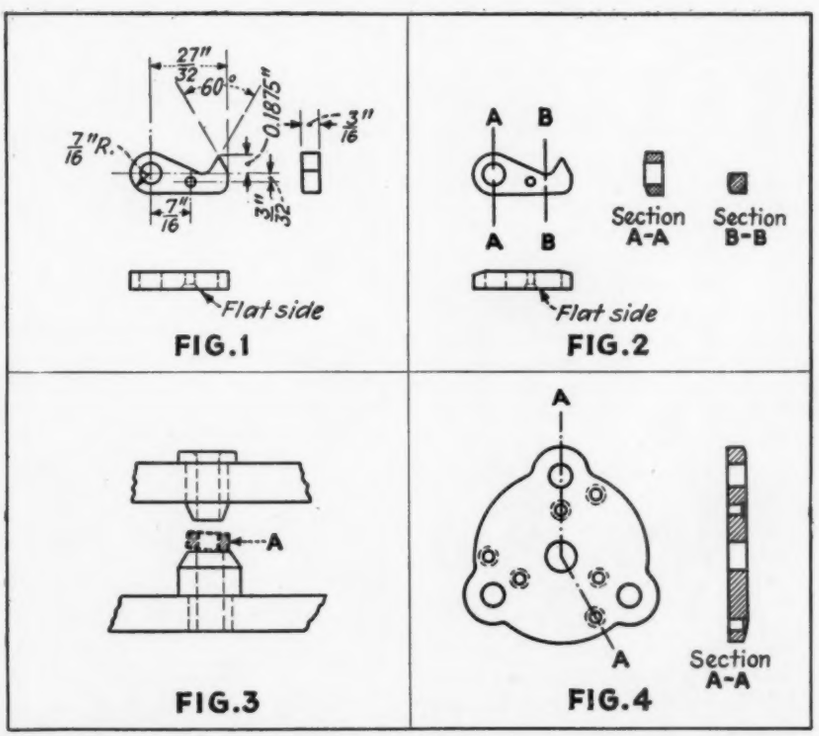
Where a part is blanked from relatively thick stock and the cross-section is small, as in Fig. 1, a flat and a round side result, as in Fig. 2. This must be taken into consideration when designing a drill jig or milling fixture for such a part. If the holes to be drilled or reamed are to be perpendicular to the flat side of the piece, the part should be set on the rest block in the jig with the flat side down. Should the round side be down a condition like that indicated at *A* in Fig. 3 can be expected. Any one of a number of factors may tilt the piece to one side or the other during the drilling operation.

Hold Against Flat Side

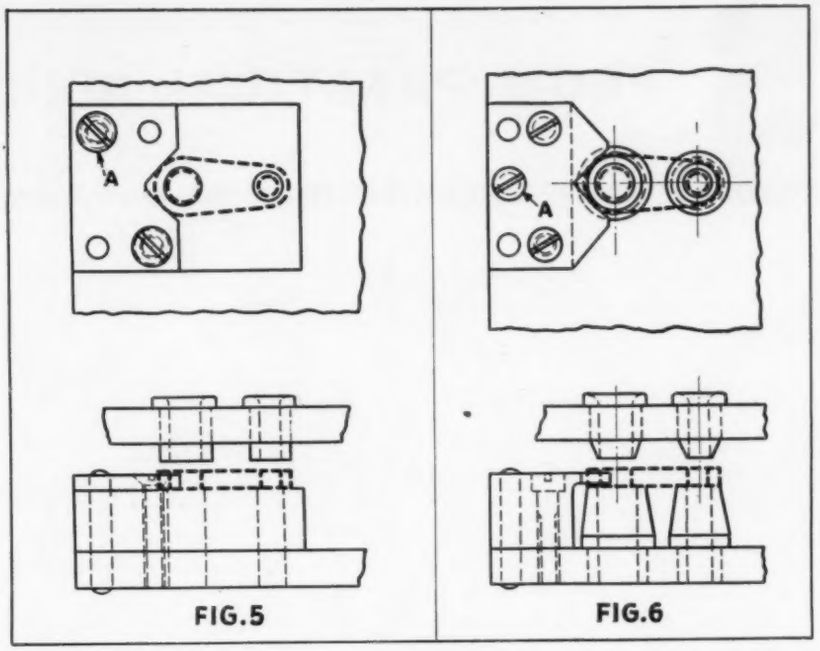
The same condition holds when designing the fixture to hold this part while milling the 60-deg. point. The flat side of the part should be held against the stationary jaw of the fixture to assure that the milled surfaces will be perpendicular to the flat side and parallel with the drilled holes.

The above precaution is necessary only when tooling for small, thick parts and can be forgotten when designing tools for a piece having a relatively large area, as in Fig. 4, since there is sufficient flat surface on the rounded side to insure against the piece shifting on the locating pads in the jig. This piece is drilled and countersunk for rivets after being blanked and, since the rivet heads are to be on the rounded side, there is an advantage in placing the round side down for drilling. The burr raised when the drill breaks through the piece can then be removed by the countersink, thus eliminating the burring operation that otherwise would be necessary.

Provision of sufficient clearance for chips is overlooked all too frequently when designing jigs and fixtures. Lack of such clearance is well illustrated by the detail sketched in Fig. 5. No provision has been made in this design for chip clearance between the V-block and the support block, and



Figs 1–4—Small, thick parts blanked from sheet stock have a flat and a rounded side. This must be considered when designing drilling or milling jigs and fixtures for second operations



Figs. 5–6—Chip clearance is of major importance when designing jigs and fixtures. The author recommends the arrangement shown at Fig. 6. Here the surfaces supporting the part have been held to a minimum and there are no corners in which chips can accumulate

none is provided on the ends of the bushings. Chips are sure to become clogged in the corners between the blocks in this arrangement and are hard to brush aside.

On the other hand, chip clearance of ample proportions has been provided in Fig. 6. There are no corners in which chips can accumulate and supporting surfaces are held to a minimum, making it easy to brush aside chips before placing another piece in the jig. The ends of the bushings have been chamfered to reduce interference with chips formed during the drilling operation.

Another common fault is the use of flat head screws for holding down locating blocks, as at *A* in Fig. 5, instead of fillister head screws like those used at *A* in Fig. 6. Flat head screws do not permit the toolmaker to shift the locating block to its proper position with relation to other parts before doweling. When fillister head screws are used, as at *A* in Fig. 6 and in Fig. 7, and clearance is provided around the screw heads, the toolmaker can position the locating block easily. In Fig. 7, the plate *A* must be located accurately with reference to the stud *B* before doweling. It is a simple matter for the toolmaker to locate the plate, transfer the dowel holes to plate *C* and press the dowels into place.

In Fig. 8 is shown the proper method for dimensioning cutter clearance on milling jaws for cutting the V in the part shown in Fig. 9. A mere statement on the tool drawing that a cutter clearance of 0.010 in. is to be allowed is not sufficient. This would force the toolmaker to check the part drawing, which sometimes is impossible and should not be necessary in any event, and make the necessary calculations. All essential dimensions should go on the tool drawing; the toolmaker should be able to complete the tool without consulting the part drawing or getting any additional information from the tool designer.

Stud Sizes Important

Frequently not enough thought is given to allowances for the fit of locating studs in holes when designing jigs and fixtures. Limits for the V cut in Fig. 9 are 0.002 in. The size of the locating studs should not be more than 0.0003 in. under the size of the holes in the part and the smaller stud should be elongated to compensate for the variation in the center distance between the holes in the part to be machined.

On the other hand, if the limits on the V cut in Fig. 9 were ± 0.005 in., then the locating studs can be as much as 0.0015 in. undersize and both pins may be round. Such looseness of the locating studs permits the operator to load and unload the work more rapidly; giving a lower production cost per piece without impairing the quality of the product.

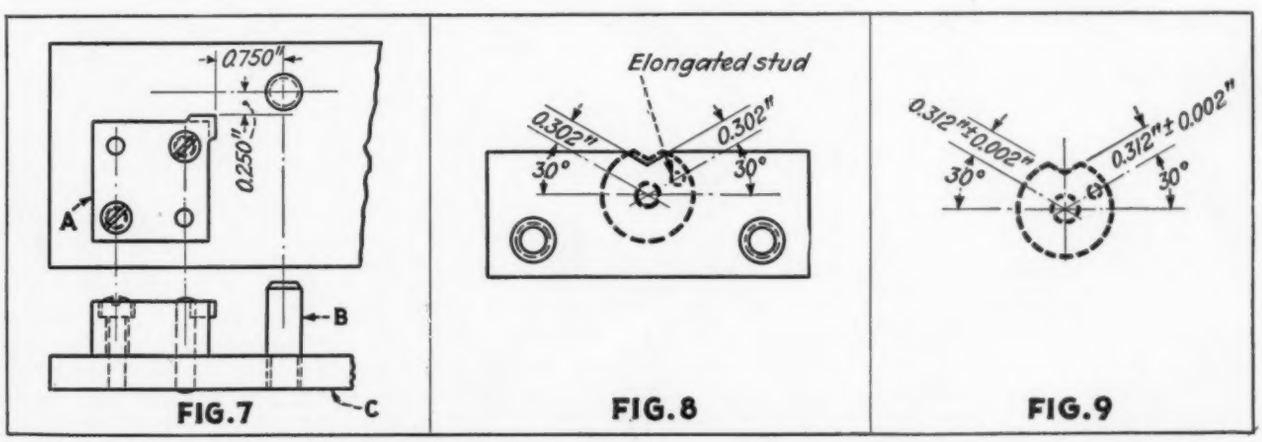


Fig. 7—The use of fillister head screws for holding tool parts is to be recommended as they make it possible for the toolmaker to shift the units into proper relation with other parts before doweling. Figs. 8–9—All necessary dimensions should be indicated on the tool drawing so that the toolmaker can go ahead with his work without checking over a part drawing. Clearances on locating studs are important.

IDEAS FROM PRACTICAL MEN

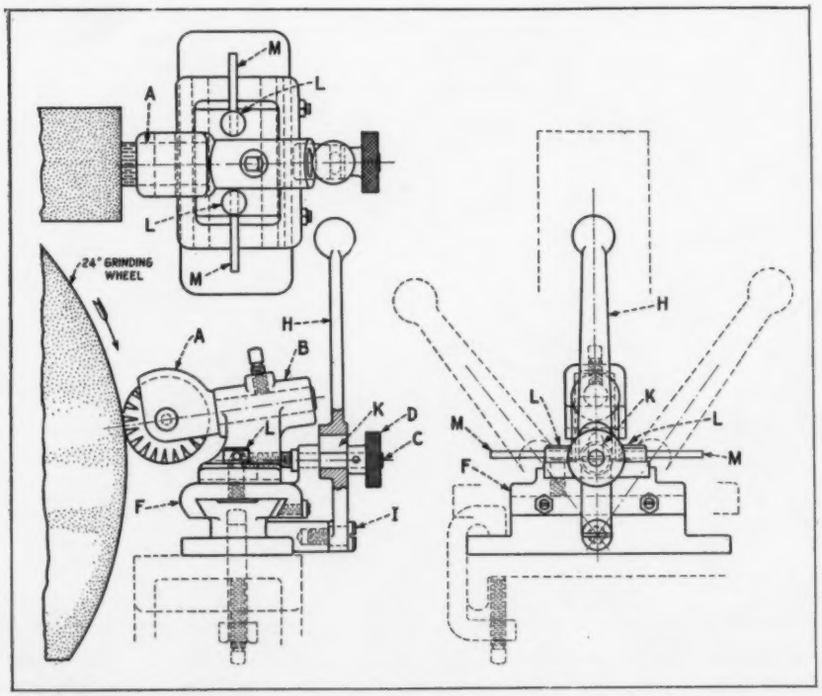
Wheel Dresser for the Floor Grinder

J. R. WHITTLES

In the illustration is shown a fixture for dressing the wheels of a floor grinder. It is attached to the work rest of the grinder by C-clamps and has two movements at right angles to each other.

The shank of the dresser *A* is held in the holder *B*, which can be moved toward or from the face of the grinding wheel by turning the adjusting screw *C* by the knurled knob *D*. The base of the dresser holder is gibbed to the carriage *F*, which is traversed across the face of the wheel by the lever *H*. The lever is pivoted at *I* and has a slot at *K* to fit the body of the adjusting screw which serves as a driver to move the carriage.

The holder can be locked in position by the binding screws *L* which are operated by the short levers *M*. As shown in the front elevation, the carriage is in the middle position of its traverse and can be moved either side of the center, as indicated by the dotted lines of the operating lever.



A wheel dresser may be applied to a floor stand grinder to minimize wheel wear and to get a true surface when grinding fixtures are attached

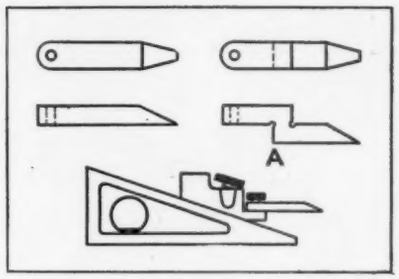
Improvised Height Gage

REX H. GOLDSMITH
Powell River, British Columbia

For work that does not require the extreme accuracy of a vernier height gage, the conventional planer gage can be used as a height gage by attaching a scriber to the sliding block, as shown in the illustration.

Where the work to be scribed requires the sliding block to set so high on the gage that the scriber will not reach it when pointed in the direction shown, the scriber can be turned at a right angle. When the line to be scribed is higher than the highest point to which the scriber can be set, it can be attached to one of the extension rods furnished with the gage, or the gage can be set on a block.

The scriber should be made of tool steel, hardened and ground. A



A planer gage having a scriber attached to the sliding block makes a good substitute for a height gage when great accuracy is not required.

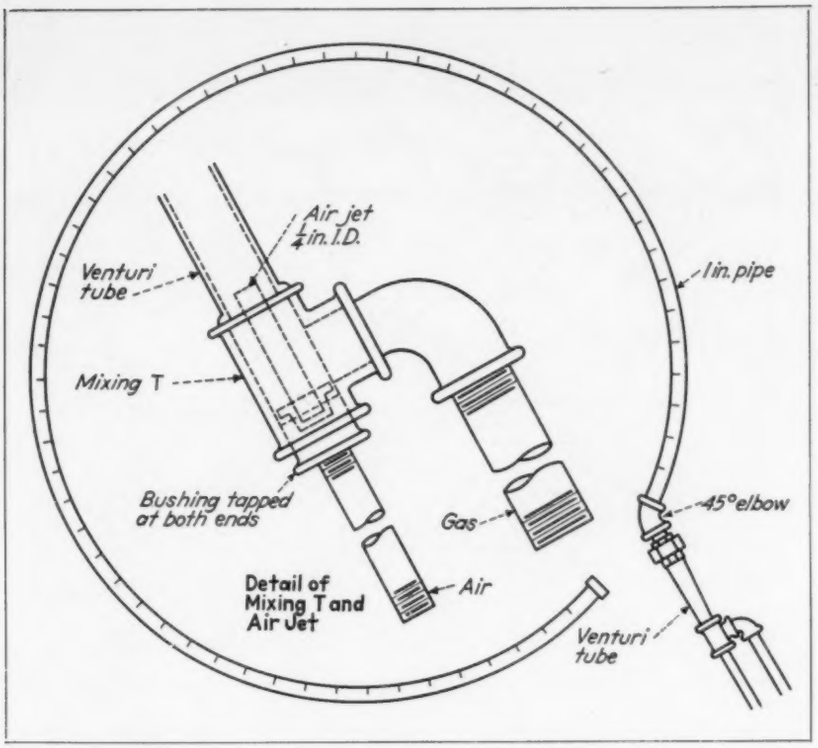
scriber having a step, such as the one shown at *A*, is useful for scribing a line on very low work, since planer gages will not usually permit a straight scriber to be set less than $\frac{1}{4}$ in. from the bottom.

"Hell-Gas" Tire Heater

H. W. SHEPHERD

Illustrated is a tire heater that can be used wherever natural gas and compressed air are available. It is arranged to operate on gas pressure of from 5 to 20 lb. and air at shop line pressure. No regulating valves are needed, only stop valves for cutting the gas and air on and off. The most important features of the heater are the mixing tee and the air jet; the latter extends slightly into a venturi tube, thus becoming an air injector using compressed air to force the gas into the burner. Ten parts of air are required to burn one part of natural gas, and the tee and jet arrangement serves as both inspirator and mixer. The tee should be placed close to the burner and connected to it by a venturi tube, the taper of which is about the same as that formed by a jet of compressed air discharging into the atmosphere. The venturi tube is an important member of the heater, since experiments have proved that it will discharge nearly twice as much gas as will a straight tube having an area the same as that of the small end of the venturi tube.

The burner proper is a ring of 1-in. pipe, which is small enough to



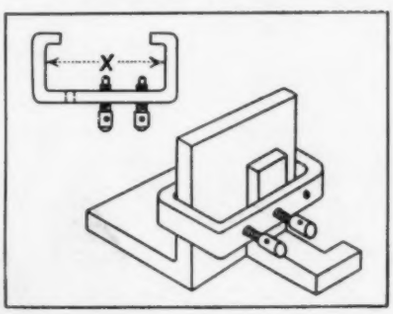
Using natural gas and compressed air, this tire heater will expand a 66-in. tire in about 12 min.

pass under the brake shoes when used to remove a tire from a locomotive in the enginehouse. A space of about 6 in. is left between the ends of the burner, one end being closed by a cap. The opposite end has a 45-deg. elbow to which the venturi tube is attached by a union. The burner is slotted with either a hacksaw or a bandsaw every 2½ in., the length of the slots being about ¼ in.

Angle-Plate Clamp

PETER L. BUDWITZ

For toolroom use, the clamp illustrated will be found very convenient for holding work of some kinds on an angle plate for various



This clamp is very convenient for holding some kinds of work on an angle plate. It takes the place of makeshift strap clamps

machining operations. It will take the place of makeshift strap clamps and has an advantage over parallel clamps because the most of them lack the necessary depth of jaws for holding many types of work effectively.

The clamp is a steel forging and is heat-treated to give it additional strength. The dimension *X* is made to correspond to the width of the angle plate on which it is to be used. It has three tapped holes for clamping screws.

Tool and Die Shop Stamping Fixture

H. R. HAGEMAN

Referring to the article under the above title by John A. Honegger (*AM*—Vol. 82, page 1152) I think it is a foregone conclusion that no one would seriously consider building such a tool for practical use, although it would be an interesting problem for a beginner in tool designing to redesign the fixture so that it might "save time and do a better job than can be done by hand." Salient suggestions are as follows:

1. The stamps should be inserted in the disk individually, so that broken or worn ones could be replaced.

2. If the disk were mounted horizontally, the stamps could be struck with a hand hammer, thus reducing the cost of the fixture without slowing its operation.

3. An angle plate should be provided to which the part to be stamped could be clamped, either flatwise or edgewise. This angle plate should slide on rollers set into the base.

4. The movable scale should be replaced by a straight-edge bar having notches along its top spaced the same as the letters and meshing with a three-position ratchet lever pivoted on the angle plate so that the first position ratchets the work the width of the capital letter I., while the second position ratchets the width of all the rest of the letters except W and M, which would require the third position.

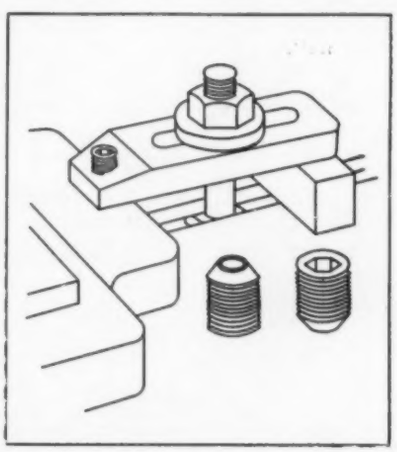
The latter part of item 4 is necessary in order to give the line of stamping a good appearance, which is part of doing a "better job."

Non-Slip Clamp

CHARLES H. WILLEY
Superintendent of Manufacturing, Hoyt Electrical Instrument Works

There are many jobs where the surfaces presented to clamps are irregular or sloping so that it is difficult to prevent the clamps from slipping.

In such cases the conventional clamp can be prevented from slip-



A cup-point setscrew inserted in a tapped hole in the toe of clamp will bite into the work and prevent the clamp from slipping

ping by drilling and tapping the toe and inserting a cup-point setscrew of the safety type, as shown in the illustration. A clamp so equipped will hold without slipping on surfaces that are irregular or that slope at quite an angle.

Study in Fixture Design

LEWIS P. SITTIG

We had to mill three flats at right angles to each other on the sides of a large quantity of tips for the nozzles of fuel injectors for diesel engines, such as the one shown enlarged in Fig. 1 at *A*. Particular accuracy as to dimensions was not required, the chief requisite being to hold the rather delicate tips firmly in alignment during the operation.

The machine tool builder who furnished the hand milling machine used for the job submitted a proposal to build the fixture shown in Fig. 1 at a price of $675, guaranteeing a production of 53 pieces per hour.

The proposed fixture was to be operated as follows: Open spring collet *B* by withdrawing collet closer arbor *C* by depressing lever *D*; insert work in collet, release pressure on lever *D*, permitting spring *F* to close collet on work; align upper end of work by the spring-actuated cup center *H* and mill the first flat. Bring table back to starting point; withdraw index latch *I* by turning lever *K* and turn index plate *L* by pin *M* in its hub until the index latch snaps into the next hole. Mill the second flat and repeat the movements for the third flat.

The index plate was to have four holes, but one hole was to be plugged by the foolproof pin *N* to make it impossible to index for more than three flats.

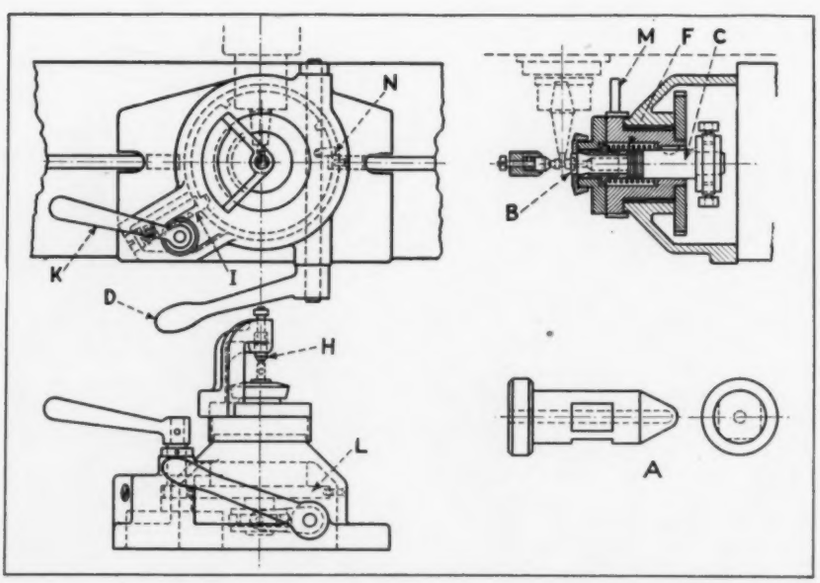


Fig. 1—Fixture proposed for milling three flat surfaces on Diesel-engine fuel-injection nozzles at a guaranteed rate of 53 pieces per hour; the machine tool builder who furnished the milling machine designed the fixture, but it was later discarded for the one shown in Fig. 2

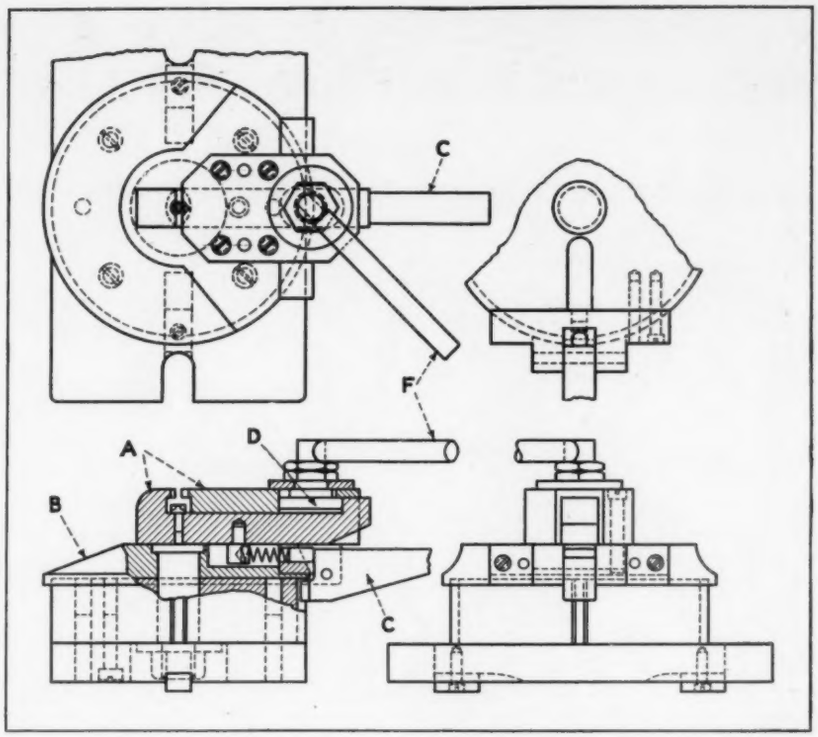


Fig. 2—This shop-built fixture cost less than the one designed by the manufacturer of the milling machine, and the number of pieces per hour produced with it exceeded the guarantee for the proposed fixture; 71 pieces per hour were produced as compared with 53 pieces per hour with the fixture shown in Fig. 1

Since neither the design of the fixture nor its production rate met with the approval of the superintendent, he commissioned our tool engineer to design a better fixture, the result being shown in Fig. 2. The cup center was to be eliminated for more rapid loading and vise jaws were to be substituted for the spring collet.

In operation, the work is held in the vise jaws *A* and is indexed by turning the swivel base *B*, which is notched for indexing by the index latch lever *C*. The vise jaws are made dirt proof by one sliding underneath the other. The eccentric *D* operated by the lever *F* is provided for quick clamping. The machine table does not have to be returned to the initial starting position for milling the second flat. It is permitted to travel far enough after the first cut to permit indexing and the second flat is milled on its return.

The fixture cost $225 to build and the production rate by its use was 71 pieces per hour. The case cited is an actual one where an experienced tool engineer saved his employer $450 in tool cost, to say nothing about the saving resulting from the greater production.

This study shows how the ingenuity and inventive ability of shop engineers and shop technicians can often be applied to advantage. Similar opportunities may not occur often, but often they can be discovered without too diligent a search.

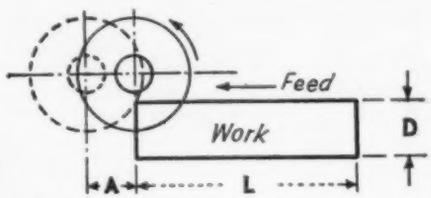
Time-Data Sheet No. 23

Milling and Profiling Time Data—VII

Continued from Time-Data Sheet No. 22 (AM—Vol. 83, page 92)

TABLE No. 10—Approach of Cutter for Spiral Mills, Side Mills, Keyway Cutters and Saws

Dia. of Cutter Inches	Depth of Cut in Inches											
	1/8	3/16	1/4	1/4	3/8	1/2	3/4	1	1 1/2	2	3	4
1 1/4	0.272	0.370	0.440	0.500	0.570	0.612						
1 1/2	0.299	0.410	0.490	0.560	0.650	0.710	0.750					
1 3/4	0.320	0.450	0.540	0.610	0.720	0.790	0.870					
2	0.350	0.480	0.580	0.660	0.780	0.870	0.970	1.000				
2 1/4	0.370	0.520	0.620	0.710	0.840	0.930	1.060	1.120				
2 1/2	0.390	0.540	0.660	0.750	0.890	1.000	1.150	1.220				
2 3/4	0.410	0.570	0.690	0.790	0.940	1.060	1.220	1.320				
3	0.430	0.600	0.730	0.830	0.990	1.120	1.300	1.410	1.500			
3 1/4	0.450	0.630	0.760	0.870	1.040	1.170	1.370	1.500	1.620			
3 1/2	0.460	0.650	0.790	0.910	1.080	1.220	1.440	1.580	1.730			
3 3/4	0.480	0.670	0.820	0.930	1.130	1.280	1.500	1.660	1.840			
4	0.490	0.700	0.850	0.970	1.170	1.320	1.560	1.730	1.940	2.000		
4 1/4	0.511	0.720	0.870	1.000	1.210	1.370	1.620	1.800	2.030	2.120		
4 1/2	0.530	0.740	0.900	1.030	1.240	1.410	1.670	1.870	2.120	2.240		
4 3/4	0.540	0.760	0.920	1.060	1.280	1.460	1.730	1.930	2.210	2.350		
5	0.560	0.780	0.950	1.090	1.320	1.500	1.790	2.000	2.290	2.450		
5 1/2	0.580	0.820	1.000	1.140	1.390	1.580	1.890	2.120	2.450	2.640		
6	0.610	0.860	1.040	1.200	1.450	1.660	1.980	2.240	2.600	2.830	3.000	
6 1/2	0.634	0.890	1.090	1.250	1.510	1.730	2.080	2.350	2.740	3.000	3.240	
7	0.650	0.930	1.130	1.300	1.580	1.800	2.170	2.450	2.870	3.160	3.460	
7 1/2	0.680	0.950	1.170	1.350	1.630	1.870	2.250	2.550	3.000	3.320	3.670	
8	0.710	0.990	1.210	1.390	1.690	1.940	2.330	2.650	3.120	3.460	3.870	4.000
8 1/2	0.730	1.030	1.250	1.440	1.740	2.000	2.410	2.740	3.240	3.610	4.060	4.240
9	0.750	1.050	1.280	1.480	1.800	2.060	2.490	2.830	3.360	3.740	4.240	4.470
9 1/2	0.770	1.080	1.320	1.520	1.850	2.120	2.560	2.920	3.470	3.880	4.420	4.690
10	0.790	1.110	1.350	1.560	1.900	2.180	2.630	3.000	3.570	4.000	4.580	4.900
10 1/2	0.810	1.140	1.390	1.600	1.950	2.240	2.710	3.080	3.670	4.120	4.750	5.100
11	0.830	1.170	1.420	1.640	2.000	2.290	2.770	3.160	3.770	4.240	4.890	5.290
11 1/2	0.850	1.190	1.460	1.680	2.040	2.340	2.840	3.240	3.870	4.360	5.040	5.480
12	0.860	1.220	1.490	1.720	2.090	2.400	2.910	3.320	3.970	4.470	5.190	5.650



A — Approach of cutter
L — Length of cut
D — Depth of cut

The approach of cutter is the distance the tables must move the work into the cutter before full cutting action takes place

TABLE No. 11—Section 1

Time in Decimal Hours of Table Travel for Milling Machine Includes the usual 10 per cent Personal allowance and 3 per cent for oiling and cleaning machine

Table Travel Inches	Feed in Inches per Minute													
	1/2	5/8	3/4	7/8	1	1 1/8	1 3/8	1 5/8	1 7/8	2 1/4	2 5/8	2 7/8	3 1/8	3 3/8
1/2	0.0190	0.0150	0.0127	0.0109	0.0095	0.0084	0.0069	0.0059	0.0051	0.0043	0.0036	0.0033	0.0031	0.0028
3/4	0.0285	0.0228	0.0199	0.0163	0.0142	0.0126	0.0103	0.0089	0.0076	0.0064	0.0054	0.0050	0.0046	0.0042
1	0.0380	0.0304	0.0253	0.0217	0.0190	0.0168	0.0138	0.0117	0.0101	0.0085	0.0072	0.0066	0.0061	0.0056
1 1/4	0.0475	0.0380	0.0316	0.0272	0.0237	0.0210	0.0173	0.0146	0.0126	0.0106	0.0090	0.0083	0.0076	0.0070
1 1/2	0.0570	0.0460	0.0380	0.0326	0.0285	0.0252	0.0207	0.0175	0.0151	0.0127	0.0108	0.0099	0.0092	0.0084
1 3/4	0.0665	0.0532	0.0443	0.0380	0.0332	0.0294	0.0242	0.0205	0.0176	0.0149	0.0126	0.0115	0.0107	0.0098
2	0.0760	0.0610	0.0510	0.0434	0.0380	0.0336	0.0276	0.0234	0.0202	0.0170	0.0144	0.0132	0.0122	0.0112
2 1/4	0.0855	0.0685	0.0570	0.0487	0.0427	0.0378	0.0310	0.0263	0.0227	0.0192	0.0162	0.0148	0.0137	0.0126
2 1/2	0.0950	0.0760	0.0630	0.0542	0.0475	0.0420	0.0345	0.0292	0.0252	0.0213	0.0180	0.0165	0.0152	0.0140
2 3/4	0.1045	0.0835	0.0695	0.0596	0.0522	0.0462	0.0380	0.0322	0.0278	0.0234	0.0198	0.0181	0.0168	0.0154
3	0.1140	0.0910	0.0760	0.0650	0.0570	0.0505	0.0415	0.0355	0.0303	0.0255	0.0216	0.0198	0.0183	0.0168
3 1/4	0.1235	0.0990	0.0822	0.0705	0.0618	0.0546	0.0450	0.0380	0.0328	0.0277	0.0234	0.0214	0.0198	0.0182
3 1/2	0.1330	0.1060	0.0890	0.0760	0.0665	0.0590	0.0483	0.0410	0.0354	0.0297	0.0352	0.0231	0.0214	0.0196
3 3/4	0.1425	0.1140	0.0950	0.0815	0.0713	0.0630	0.0517	0.0438	0.0378	0.0319	0.0270	0.0248	0.0229	0.0210
4	0.1520	0.1220	0.1010	0.0867	0.0760	0.0673	0.0553	0.0467	0.0403	0.0340	0.0288	0.0264	0.0244	0.0224
4 1/4	0.1610	0.1290	0.1075	0.0920	0.0807	0.0715	0.0587	0.0497	0.0430	0.0340	0.0306	0.0280	0.0259	0.0238
4 1/2	0.1710	0.1370	0.1140	0.0975	0.0855	0.0755	0.0621	0.0527	0.0454	0.0382	0.0324	0.0297	0.0274	0.0252
4 3/4	0.1800	0.1440	0.1200	0.1030	0.0900	0.0797	0.0655	0.0555	0.0480	0.0404	0.0342	0.0314	0.0290	0.0266
5	0.1900	0.1520	0.1262	0.1070	0.0950	0.0840	0.0690	0.0585	0.0505	0.0425	0.0360	0.0330	0.0305	0.0280
5 1/2	0.2090	0.1670	0.1390	0.1190	0.1042	0.0925	0.0760	0.0644	0.0555	0.0467	0.0396	0.0363	0.0335	0.0308
6	0.2280	0.1820	0.1520	0.1300	0.1140	0.1010	0.0830	0.0720	0.0605	0.0510	0.0432	0.0396	0.0366	0.0336
6 1/2	0.2470	0.1980	0.1640	0.1410	0.1232	0.1090	0.0895	0.0760	0.0655	0.0552	0.0467	0.0429	0.0396	0.0364
7	0.2660	0.2130	0.1770	0.1520	0.1330	0.1175	0.0965	0.0820	0.0707	0.0595	0.0503	0.0462	0.0427	0.0392
7 1/2	0.2850	0.2280	0.1890	0.1620	0.1420	0.1260	0.1035	0.0877	0.0760	0.0637	0.0540	0.0496	0.0457	0.0420
8	0.3040	0.2430	0.2020	0.1735	0.1520	0.1340	0.1100	0.0935	0.0810	0.0680	0.0575	0.0528	0.0487	0.0447
8 1/2	0.3230	0.2580	0.2150	0.1840	0.1610	0.1430	0.1170	0.0995	0.0860	0.0720	0.0610	0.0562	0.0518	0.0475
9	0.3420	0.2740	0.2280	0.1950	0.1710	0.1510	0.1240	0.1050	0.0910	0.0765	0.0647	0.0594	0.0550	0.0503
9 1/2	0.3600	0.2880	0.2400	0.2060	0.1800	0.1595	0.1310	0.1110	0.0960	0.0806	0.0683	0.0627	0.0580	0.0531
10	0.3800	0.3040	0.2530	0.2170	0.1900	0.1680	0.1380	0.1170	0.1010	0.0850	0.0720	0.0660	0.0610	0.0560
11	0.4180	0.3340	0.2780	0.2370	0.2090	0.1850	0.1520	0.1290	0.1110	0.0935	0.0792	0.0726	0.0670	0.0615

Table travel = Length of cut plus approach of cutter (*Continued on next page*)

Time-Data Sheet No. 24

Milling and Profiling Time Data—VIII

TABLE No. 11—Section 1—Continued

Time in Decimal Hours of Table Travel for Milling Machine Includes the usual 10 per cent Personal allowance and 3 per cent for oiling and cleaning machine

Table Travel Inches	*Feed in Inches per Minute*													
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	2¼	2⅝	2⅞	3⅛	3⅜
12	0.4560	0.3650	0.3040	0.2600	0.2280	0.2020	0.1660	0.1400	0.1210	0.1020	0.0865	0.0793	0.0730	0.0670
13	0.4950	0.3950	0.3290	0.2820	0.2470	0.2190	0.1795	0.1520	0.1310	0.1100	0.0935	0.0859	0.0794	0.0727
14	0.5320	0.4250	0.3540	0.3040	0.2660	0.2350	0.1930	0.1640	0.1410	0.1190	0.1010	0.0924	0.0855	0.0783
15	0.5700	0.4560	0.3800	0.3260	0.2850	0.2520	0.2070	0.1755	0.1510	0.1275	0.1080	0.0990	0.0915	0.0840
16	0.6100	0.4860	0.4050	0.3470	0.3040	0.2690	0.2210	0.1870	0.1610	0.1360	0.1150	0.1055	0.0975	0.0895
17	0.6450	0.5160	0.4300	0.3680	0.3230	0.2860	0.2350	0.1990	0.1720	0.1440	0.1220	0.1120	0.1040	0.0950
18	0.6850	0.5470	0.4450	0.3900	0.3420	0.3020	0.2480	0.2100	0.1820	0.1530	0.1295	0.1190	0.1100	0.1010
19	0.7230	0.5770	0.4800	0.4120	0.3600	0.3200	0.2620	0.2220	0.1920	0.1620	0.1370	0.1250	0.1160	0.1060
20	0.7600	0.6080	0.5060	0.4340	0.3800	0.3360	0.2760	0.2340	0.2020	0.1700	0.1440	0.1320	0.1220	0.1120
21	0.8000	0.6380	0.5320	0.4550	0.4000	0.3520	0.2900	0.2460	0.2120	0.1790	0.1510	0.1390	0.1280	0.1175
22	0.8350	0.6690	0.5570	0.4770	0.4180	0.3700	0.3040	0.2570	0.2220	0.1870	0.1580	0.1450	0.1340	0.1230
23	0.8750	0.6990	0.5800	0.5000	0.4370	0.3860	0.3180	0.2690	0.2320	0.1960	0.1650	0.1520	0.1400	0.1290
24	0.9100	0.7300	0.6060	0.5200	0.4550	0.4030	0.3320	0.2800	0.2420	0.2040	0.1730	0.1580	0.1460	0.1350
25	0.9500	0.7600	0.6330	0.5420	0.4750	0.4200	0.3450	0.2920	0.2520	0.2120	0.1800	0.1650	0.1520	0.1400
26	0.9900	0.7900	0.6590	0.5640	0.4950	0.4370	0.3590	0.3040	0.2620	0.2200	0.1870	0.1720	0.1580	0.1450
27	1.0250	0.8200	0.6830	0.5850	0.5130	0.4540	0.3730	0.3160	0.2720	0.2300	0.1950	0.1780	0.1650	0.1510
28	1.0650	0.8500	0.7070	0.6080	0.5320	0.4700	0.3860	0.3280	0.2830	0.2380	0.2020	0.1850	0.1710	0.1570
29	1.1000	0.8800	0.7330	0.6290	0.5500	0.4870	0.4000	0.3390	0.2920	0.2470	0.2090	0.1910	0.1770	0.1620
30	1.1400	0.9100	0.7590	0.6500	0.5700	0.5040	0.4140	0.3500	0.3040	0.2550	0.2160	0.1980	0.1830	0.1680

Table travel = Length of cut plus approach cutter

TABLE No. 11—Section 2

Table Travel Inches	*Feed in Inches per Minute*												
	3⅛	4	4¼	4¾	5	5⅝	6⅛	6¾	7¼	7¾	8¾	9¼	9¾	11¾
½	0.0026	0.0024	0.0022	0.0020	0.0019	0.0017	0.0016	0.0014	0.0013	0.0012	0.0011	0.0010	0.0009	0.0008
1	0.0052	0.0047	0.0044	0.0040	0.0038	0.0034	0.0031	0.0028	0.0026	0.0024	0.0022	0.0020	0.0019	0.0016
1½	0.0078	0.0071	0.0067	0.0060	0.0057	0.0050	0.0047	0.0042	0.0039	0.0037	0.0032	0.0031	0.0029	0.0024
2	0.0104	0.0095	0.0089	0.0080	0.0076	0.0067	0.0062	0.0056	0.0052	0.0049	0.0043	0.0041	0.0039	0.0032
2½	0.0130	0.0118	0.0110	0.0100	0.0095	0.0084	0.0078	0.0070	0.0065	0.0061	0.0054	0.0051	0.0049	0.0040
3	0.0156	0.0142	0.0133	0.0120	0.0114	0.0101	0.0093	0.0084	0.0078	0.0073	0.0065	0.0061	0.0058	0.0048
3½	0.0182	0.0166	0.0156	0.0140	0.0133	0.0117	0.0108	0.0098	0.0091	0.0085	0.0076	0.0072	0.0068	0.0056
4	0.0208	0.0189	0.0178	0.0160	0.0152	0.0134	0.0124	0.0112	0.0104	0.0098	0.0087	0.0082	0.0078	0.0064
4½	0.0234	0.0213	0.0200	0.0180	0.0171	0.0151	0.0140	0.0126	0.0117	0.0110	0.0097	0.0092	0.0087	0.0073
5	0.0260	0.0237	0.0222	0.0200	0.0190	0.0168	0.0155	0.0140	0.0130	0.0122	0.0108	0.0102	0.0097	0.0081
5½	0.0286	0.0260	0.0245	0.0220	0.0209	0.0185	0.0170	0.0154	0.0143	0.0134	0.0119	0.0112	0.0107	0.0089
6	0.0312	0.0284	0.0267	0.0240	0.0228	0.0200	0.0186	0.0168	0.0156	0.0146	0.0129	0.0122	0.0116	0.0097
6½	0.0338	0.0308	0.0290	0.0260	0.0247	0.0218	0.0201	0.0182	0.0169	0.0158	0.0140	0.0132	0.0126	0.0105
7	0.0364	0.0331	0.0312	0.0280	0.0266	0.0235	0.0217	0.0196	0.0182	0.0170	0.0151	0.0143	0.0136	0.0113
7½	0.0390	0.0355	0.0334	0.0300	0.0285	0.0252	0.0232	0.0210	0.0195	0.0183	0.0162	0.0153	0.0145	0.0121
8	0.0416	0.0379	0.0356	0.0320	0.0304	0.0268	0.0248	0.0224	0.0208	0.0195	0.0173	0.0163	0.0155	0.0129
8½	0.0442	0.0402	0.0378	0.0340	0.0323	0.0286	0.0263	0.0238	0.0221	0.0208	0.0183	0.0173	0.0165	0.0137
9	0.0468	0.0425	0.0400	0.0360	0.0342	0.0302	0.0280	0.0252	0.0234	0.0220	0.0194	0.0184	0.0174	0.0145
9½	0.0493	0.0450	0.0423	0.0380	0.0360	0.0320	0.0294	0.0266	0.0247	0.0232	0.0205	0.0194	0.0184	0.0153
10	0.0520	0.0473	0.0445	0.0400	0.0380	0.0336	0.0310	0.0280	0.0260	0.0244	0.0216	0.0204	0.0194	0.0161
11	0.0572	0.0522	0.0490	0.0440	0.0417	0.0370	0.0340	0.0308	0.0286	0.0268	0.0237	0.0224	0.0214	0.0177
12	0.0625	0.0567	0.0535	0.0480	0.0456	0.0403	0.0372	0.0336	0.0312	0.0293	0.0259	0.0245	0.0233	0.0193
13	0.0675	0.0615	0.0578	0.0520	0.0494	0.0437	0.0403	0.0364	0.0338	0.0317	0.0281	0.0265	0.0252	0.0201
14	0.0727	0.0664	0.0623	0.0560	0.0532	0.0470	0.0434	0.0392	0.0364	0.0342	0.0302	0.0286	0.0272	0.0226
15	0.0780	0.0710	0.0667	0.0600	0.0570	0.0504	0.0465	0.0420	0.0390	0.0366	0.0324	0.0306	0.0290	0.0242
16	0.0830	0.0757	0.0712	0.0640	0.0610	0.0537	0.0495	0.0448	0.0415	0.0390	0.0345	0.0327	0.0310	0.0258
17	0.0885	0.0805	0.0755	0.0680	0.0646	0.0570	0.0527	0.0475	0.0442	0.0415	0.0367	0.0347	0.0330	0.0274
18	0.0935	0.0850	0.0800	0.0720	0.0684	0.0605	0.0560	0.0503	0.0468	0.0440	0.0388	0.0367	0.0350	0.0290
19	0.0990	0.0900	0.0845	0.0760	0.0720	0.0630	0.0590	0.0532	0.0495	0.0464	0.0410	0.0388	0.0368	0.0306
20	0.1040	0.0950	0.0890	0.0800	0.0760	0.0670	0.0620	0.0560	0.0520	0.0490	0.0433	0.0408	0.0390	0.0322
21	0.1090	0.0995	0.0935	0.0840	0.0800	0.0705	0.0650	0.0588	0.0545	0.0513	0.0454	0.0430	0.0407	0.0340
22	0.1140	0.1040	0.0980	0.0880	0.0835	0.0740	0.0683	0.0615	0.0573	0.0537	0.0475	0.0450	0.0427	0.0355
23	0.1195	0.1085	0.1020	0.0920	0.0875	0.0770	0.0715	0.0645	0.0597	0.0560	0.0497	0.0470	0.0445	0.0370
24	0.1250	0.1140	0.1070	0.0960	0.0910	0.0805	0.0745	0.0672	0.0623	0.0585	0.0518	0.0490	0.0465	0.0390
25	0.1300	0.1180	0.1110	0.1000	0.0950	0.0840	0.0775	0.0700	0.0650	0.0610	0.0540	0.0510	0.0485	0.0400
26	0.1360	0.1230	0.1150	0.1040	0.0990	0.0875	0.0805	0.0730	0.0675	0.0635	0.0560	0.0530	0.0505	0.0420
27	0.1410	0.1280	0.1200	0.1080	0.1030	0.0910	0.0835	0.0755	0.0700	0.0660	0.0585	0.0550	0.0525	0.0435
28	0.1460	0.1320	0.1240	0.1120	0.1060	0.0940	0.0870	0.0785	0.0730	0.0685	0.0605	0.0570	0.0545	0.0450
29	0.1510	0.1370	0.1290	0.1160	0.1100	0.0975	0.0900	0.0810	0.0755	0.0710	0.0625	0.0590	0.0562	0.0468
30	0.1570	0.1420	0.1330	0.1200	0.1140	0.1010	0.0930	0.0840	0.0780	0.0730	0.0650	0.0610	0.0582	0.0483

Table travel = Length of cut plus approach of cutter

Appeasement–American Style

APPEASEMENT is a term associated in everyone's mind with Mr. Chamberlain and his now famous umbrella. No matter what you or I may think of his appeasement policy, it averted a disastrous war last September.

Now the appeasement technique is being used in this country by government, with the support of organized labor, in an attempt to restore confidence to the industrial community. Words unfamiliar to the ears of business men have come recently from the lips of government and union spokesmen. Said the American Federation of Labor's executive council, "We believe that private initiative . . . should be encouraged and supported. . . Those who invest in private industry should earn a fair return upon such investment."

Secretary Morgenthau has unexpectedly suggested that Congress reexamine the tax structure to remove any obstructions to business enterprise and economic recovery.

At Des Moines Secretary Hopkins soothed the nerves of business by saying that the administration has now shifted the emphasis from reform to recovery. He remarked that "lack of business confidence . . . may be as real a deterrent to restored business health as any we have to deal with." He continued, "I believe any federal taxes which tend to freeze the necessary flow of capital should be amended."

Even Mr. Roosevelt has been moved to remark that no new taxes are planned and that no new government excursions into the power industry are planned.

If this ardent wooing does not immediately accomplish its purpose, industry can hardly be blamed. It has heard pretty speeches before only to have the government fail to make good on its avowals.

This much should be said, however. The atmosphere in Washington has changed recently. Either by choice or necessity, many New Dealers have modified their ideas. The feeling that reform has been displaced by recovery appears genuine. Whether this is due to the impending 1940 election or to a real change of heart is beside the point. The fact is that it exists and does not seem to be a fleeting thing.

There is a distinct difference between appeasement here and abroad.

In Europe appeasement is being pursued by those willing to make concessions to avoid being whacked on the head by the big stick wielded by the totalitarian powers.

In this country an appeasement policy and the big stick are both tucked under the arm of one party—the government. If it uses one today, maybe it will prefer to use the other tomorrow.

Best proof of business men that it is committed to appeasement as a means of economic recovery would be for it to put aside the big stick entirely. If it does that and business wholeheartedly cooperates, private enterprise will be given that chance which it has been seeking to put the country back on its economic feet.

Burnham Finney

GAGING BUSINESS

Strong volume of machine tool business in February and increasing number of inquiries provide brighter spring prospects. Proportion of domestic orders increases

A strong upward surge of inquiries indicates that machine tool business this spring should be prosperous. A larger proportion of pending orders is from domestic buyers, a development which is encouraging to machinery builders. Export sales, however, continue strong and have accounted for a substantial share of February's good volume. Steel companies are mildly optimistic about the outlook. The steel rate is gradually creeping up, with rail and tin plate tonnage notable. Several large motor car makers have boosted March production from 20 to 35 per cent above the February total. Railroad equipment purchases have been active and are expected to be of considerable size this month. The stimulating effect of government buying is being felt in a constantly widening circle of metal-working plants as companies with direct contracts sublet the manufacture of parts. Makers of heavy electrical equipment did a good business during February. Conditions in the aircraft industry are spotty, but will improve soon with the award of army and navy orders.

NEW ENGLAND—Machine tool sales have been good and inquiries are excellent. Government buying continues conspicuous. For example, the Boston Navy Yard expects to purchase turret lathes, the Springfield Armory automatic milling machines and the Watertown Arsenal several lathes. Private shipyards are not active buyers at the moment, but tools for battleship and destroyer use will be required later. Makers of automobile fabrics are doing fairly well.

NEW YORK—Government spending is chiefly responsible for improvement in machinery orders. Considerable gains are reported in small tools and in sheet metal working equipment. The number of outstanding inquiries is large. Pending machine tool business at Philadelphia is sizable, but current sales are lean.

PITTSBURGH—Steel mills look for a slow, unspectacular upward trend of business this spring, with a strong possibility that operations will get above 60 per cent. A large manufacturer of electrical equipment expects to spend several million dollars for new machinery for modernization purposes this year. Dealers say that orders for small machine tools are gaining and that steel companies are figuring on important expansion or replacement programs for large machine tools.

CLEVELAND—Orders for machine tools have slumped to a level close to that in '32. Steel operations, too, have not felt the impetus reported in some other districts, partly because of postponement of automotive releases. A rise in small tool business, however, foreshadows generally improved conditions.

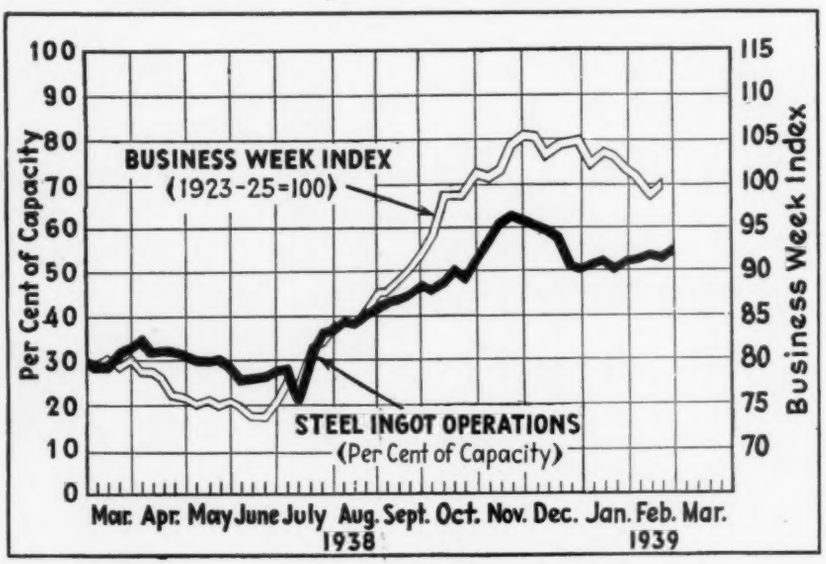
DETROIT—Die shops are getting releases for 1940 model jobs. They anticipate one of the best seasons in years. Inquiries have "flooded out" machine tool companies, at first for routine changes in existing equipment and fixtures, but lately for new machinery to handle new parts. Sales, however, are poor. The small tool and mill supply trade continues on a hand-to-mouth basis with competition exceedingly keen for existing business. At Toledo auto parts factory employment is about the same as a year ago. Electric Auto-Lite has been running close to capacity since last fall.

CINCINNATI—Machine tool volume is mounting. Though much of it is from foreign sources, an increasing percentage is of domestic origin, government contracts and armament orders accounting for a healthy chunk. Two companies report the largest number of inquiries in their history. Orders and inquiries at Dayton are above those of a year ago.

CHICAGO—Sentiment in the metal-working trade is good. Machinery sales and outstanding quotations are of substantial volume. The steel rate is advancing slowly because of automotive tonnage and because of small orders from diversified sources. Construction machinery makers say that prospects are brighter. Kearney & Trecker is operating at the highest level in its history. Zenith Radio's February shipments were double those in the same month of 1938. Twin Disc Clutch is said to have completed purchases of equipment for its marine clutch division.

STEEL INGOT OPERATIONS VS. GENERAL BUSINESS

Although general business activity continued to decline slightly, steel ingot production maintained its gradual advance, thanks to an increased volume of more diversified orders



NEWS OF THE INDUSTRY

STEEL INDUSTRY WILL SPEND APPROXIMATELY $126,000,000 FOR NEW EQUIPMENT IN 1939

NEW YORK—Approximately $126,000,000 will be spent by steel companies during 1939 for new construction and equipment, according to reports received by the American Iron & Steel Institute from 150 companies representing more than 90 per cent of the total capacity of the industry.

The amount budgeted for 1939 is less than was spent in any of the preceding four years, but raises the total for the five-year period to nearly $1,000,000,000. However, a number of companies have indicated that certain additional projects now under consideration might be started if the business outlook improves sufficiently.

This year's slight decline in new equipment and construction expenditures reflects not only the generally unprofitable level of steel operations last year, but also the fact that most of the major plant expansion programs which have been in progress during the past several years have now been completed or are nearing completion.

Modernization of existing equipment is the principal item of the industry's construction program for 1939. No new continuous hot sheet mills, blast furnaces or steel furnaces are reported under construction.

GOVERNMENT ORDERS HEAVY; NAVY CONTRACTS PROMINENT

WASHINGTON—Michigan Tool Co., Detroit, has been awarded a contract for gear reduction units for the Navy at a cost of $127,596. Other recent government contracts include American Tool Works, Cincinnati, engine lathes for Navy, $71,379; Baldwin-Southwark Corp., Eddystone, Pa., forging press for Navy., $49,950; Snow & Petrelli Mfg. Co., New Haven, Conn., diesel engine parts for Navy, $41,499; Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., automatic pistols for War Department, $99,935; Erie Forge Co., Erie, Pa., steel castings for Navy, $46,000.

Chances of Labor Peace Improve as a Result of Supreme Court's N.L.R.B. Decisions

C.I.O. FOR AUTO WORKERS

DETROIT—Leaders of the Congress for Industrial Organizations are confident of victory in their battle with Homer Martin. Their biggest job, so they say, is to hold the membership of the United Automobile Workers in hand until the convention scheduled for March 27. E. J. Thomas, temporary president, is said to have shown great development in his short period in that office and today is the leading candidate for president, unless the delegates draft Philip Murray. Frankensteen is not given a chance and Mortimer is barred because of his Communist leanings. Walter Ruether is recognized as an able leader. He had the distinction of never having had a sitdown strike by members of his West Side local in Detroit, the biggest local in the U.A.W.

Final Outcome Hinges Largely on Application of Pressure by President

By FRANK RISING

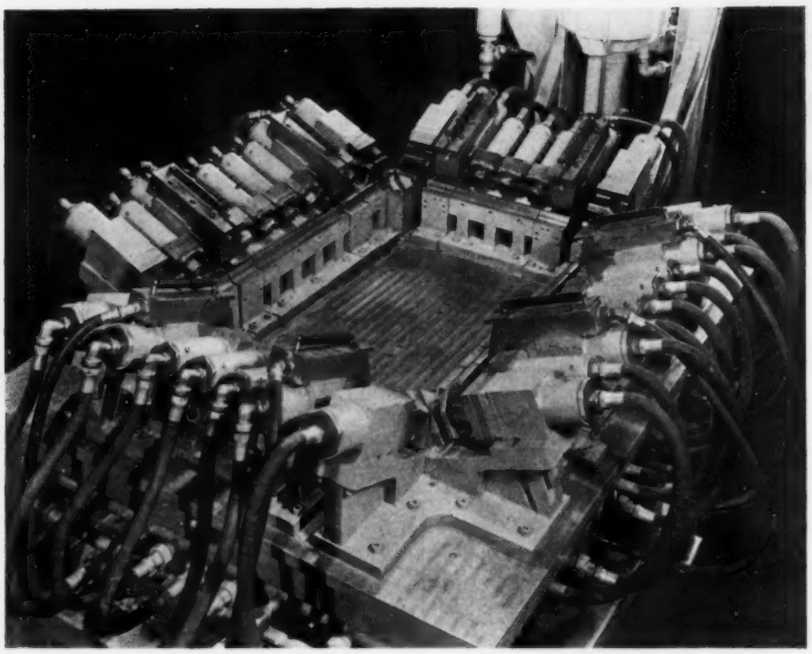
Labor Editor, American Machinist

NEW YORK—"No compromise" was changed to "Well, maybe" in the divided headquarters camps of A.F.L. and C.I.O. this week, as the rank and file of the unions continued to press for peace within the two houses of organized labor. Reason for the increased pressure was, of course, the Supreme Court decisions rendered on February 27 and the consequent tightening-up of employers on all fronts.

Most complete and final on the subject of sitdown strikes, the Supreme Court rulings in the Fansteel, Columbian Enameling, and Sands Manufacturing cases raised some doubt in the minds of observers about border-line disputes which, no doubt, will be rising to plague the courts in the near future. It is entirely possible, and even probable,

Acme

Two out of Three—*C.I.O. president John L. Lewis gets a tip from Sidney Hillman, his right-hand man (along with Philip Murray) in the raging U.A.W. controversy. The three comprise a committee to discuss peace possibilities with a committee named by A.F.L. president William Green*



One Fixture, Five Sizes—*Representing a novel departure in the manufacture of varying sizes of refrigerator door panels, this single hydraulic punching and stripping fixture has been placed in operation at the Nash-Kelvinator Corp. plant in Detroit. Designed by Progressive Welder Co., the fixture, which consists of 26 hydraulic punching units mounted on a machined steel base plate, enables the punching of a minimum of 22 up to a maximum of 52 holes in the transverse flanges of five different size refrigerator door panels. Eight hydraulically operated hold-down pads position the work and prevent misalignment between punch and die.*

Exports of Machinery During January, 1939

	January 1939	December 1938	January 1938
Electrical machinery	$6,719,583	$9,876,700	$7,787,058
Power generating machinery except automotive and electric	746,076	1,278,872	3,529,424
Construction and conveying machinery	1,479,316	2,218,115	1,934,184
Mining, well and pumping machinery	4,439,621	4,991,166	4,597,388
Power driven, metal-working machinery	6,340,620	9,873,371	5,968,604
Other metal-working machinery	332,635	330,815	297,761
Textile machinery	656,890	663,598	1,004,746

Exports of Metal-Working Machinery During January, 1939

Engine lathes	505,688	383,696	601,088
Turret lathes	384,257	348,816	414,747
Other lathes	145,049	171,999	276,880
Vertical boring mills and chucking machines	308,191	335,598	55,326
Thread cutting and automatic screw machines	225,119	473,073	291,171
Knee and column type milling machines	302,917	269,346	447,522
Other milling machines	548,960	1,411,354	318,557
Gear-cutting machines	238,616	269,832	128,085
Vertical drilling machines	60,503	95,717	39,802
Radial drilling machines	24,927	51,389	48,295
Other drilling machines	75,683	151,431	116,404
Planers and shapers	239,147	541,825	25,101
Surface grinding machines	106,407	436,454	105,288
External cylindrical grinding machines	216,848	287,885	119,915
Internal grinding machines	277,928	267,357	237,360
Tool grinding, cutter grinding, and universal grinding machines	205,972	320,432	186,241
Other metal-grinding machines and parts	452,439	396,650	188,251
Sheet and plate metal-working machines and parts	342,085	775,534	386,725
Forging machinery and parts	313,789	556,923	268,687
Rolling mill machinery and parts	603,402	1,472,350	1,061,003
Foundry and molding equipment and parts	74,698	47,256	148,459
Other power-driven metal-working machinery and parts	687,495	808,454	512,679

Other Metal-Working Machinery

Pneumatic portable tools	109,152	100,807	88,648
Portable and hand and foot operated metal-working machines and parts	121,395	101,582	92,183
Chucks for machine tools	13,953	32,466	19,452
Milling cutters, machinery operated thread dies and taps and similar machinery operated metal cutting tools	31,398	59,697	48,323
Other metal-working machine tools	56,737	36,263	49,155

that some employers on hasty reading of the decisions will be inclined to push their luck a bit—which might mean arbitrary discharge of many workers for using their *legal* striking privileges. Industrial relations advisers would be well warned to stick to the facts of the Supreme Court rulings: The sitdown strike is outlawed, strikes in violation of contract offer a sturdy defense against rehiring, and N.L.R.B. findings of discrimination must be supported by substantial evidence—not hearsay or "inference."

Peace Unlikely, But—

As to peace between A.F.L. and C.I.O., no man can guess the final outcome. Putting all the pieces together at this time, a fairly good picture is obtained which yields the following summations:

1. To a considerable degree, the final outcome of inter-federation conferences depends on how far President Roosevelt wishes to go in swinging the big stick. The stick is rank-and-file labor sentiment, plus public opinion. If the President keeps the heat on the conferees, making their responsibility so unmistakeable to the public that failure to agree would bring general condemnation, they will find a way to get together. Otherwise, no dice.

2. No one has found a formula which will put A.F.L. and C.I.O. into the same boat. But there is a very good chance that they can operate their separate boats without undue bumping or swinging of oars against each other. That is to say, a permanent truce could be arranged, with territories marked off for industrial and craft unions, and with a joint council to resolve their differences on the legislative front. With such an arrangement, the various highly jealous leaders could all keep their jobs.

3. A growing sentiment in the ranks of the unions for action may turn into repudiation of some of the leaders, if action is not had within a few weeks. This was not so true before the recent Supreme Court decisions, but now a fear is widespread on the union front that union busters will use the present anti-strike trend to cripple the Wagner Act, push State restrictive laws, and generally play hob with the whole organized labor movement.

It's up to the Leaders

All of which, in simple words, means that it is up to the union leaders themselves. If statesmanship is shown at this time, many former proponents of Wagner Act amendment are willing to lay down their guns and go forward with better feeling. If, however, the unions choose this time to display more truculence or to sulk in their trenches, there's no telling how far back they may be pushed.

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

Extensive changes in body styling give promise of considerable die work during coming months. Prospects of labor peace spurs release of orders

DETROIT—So many changes in body styling have been made for the 1940 cars that local die shops declare there will be plenty of work to go around this spring. Some of the larger shops are already busy on Buick, Packard and Pontiac work, with Ternstedt about ready to give out its usual large volume of detail changes in tools for body hardware. From preliminary releases, it is believed that the die business will break fast, and that it is not mainly destined to leave town as it did a year ago. Labor troubles prevalent then have disappeared and the men are principally interested in holding their jobs. So car manufacturers, confident that their work will not be held up by local labor conditions, are releasing an unusually large number of jobs for quotation.

Better Streamlining

Streamlining is to get an even stronger play on next year's models. Apparently the public wants more of the styling established in the Lincoln-Zephyr. Other motor-car makers are going to give the public just that, but with strong bids for individuality. Informed quarters say that General Motors, for example, is giving streamlining more emphasis, and rest their case on what is being done with Pontiac and Buick. These models are expected to have fenders with an integral headlamp, but not of the flush-mounted type as in Ford and Chrysler products. Headlamps on 1939 G.M. cars are extremely long bullet-shaped affairs nestling between the crown of the fender and the hood. But '40 models are said to have somewhat similar headlamps drawn integral with the crown in the fender. That job, if carried through, will mean an extremely difficult draw. Experienced die shop operators doubt whether it can be done in production without cutting a hole in the fender and welding a headlamp shell in place.

See Upturn in Production

Automobile production in February was adversely affected by the weather, by catching up with orders and dealer stocks, and by strikes, principally jurisdictional squabbles at Plymouth and Dodge, or in the Briggs plant which supplies the. However, production for the month stood at approximately 310,000 units. With 360,000 for January and larger schedules for March, the industry should turn out over a million cars during the first quarter, and possibly over 1,100,000.

Other evidences of more thorough adoption of streamlining principles are noted from reports that Pontiac and Buick front fenders will probably have less "break" at the back end where they merge in with the body and rapidly disappearing runningboard. The conclusion may be drawn that bodies will be wider to preserve an unbroken contour. At the rear of the car, the fast back, instead of the trunk back, appears scheduled for more universal adoption. General Motors cars all feature the trunk back for 1939 because of a customer demand for that feature, but preliminary reports are that some '40 models at least will have the fast back because of a strong and growing demand. Some of the present fast-back models overhang to such an extent that they scrape when going up a steep driveway from a level street. Other fast backs, principally on the smaller cars, do not overhang but look stubby and do not have the trunk capacity of the out-and-out trunk design.

More Luxurious Interiors

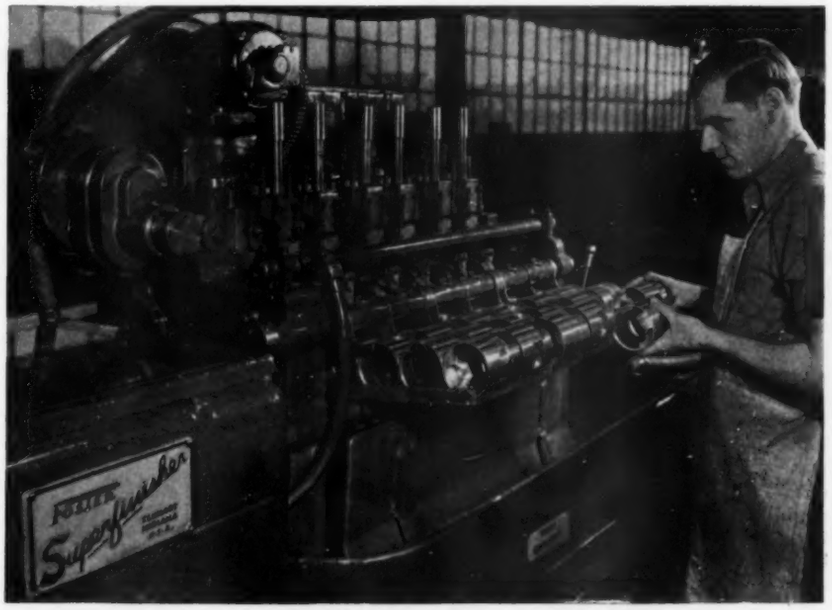
Interior styling, at least in Chrysler cars, will be more luxurious, more tricked out with novel upholstery effects and brighter colors, the latter mostly gained with colorful plastics. Several score of different trim combinations are now available in that corporation's models, and there seems to be no tendency to reduce customer options.

Steel Men Optimistic

Local steel men view March as bringing in a strong volume of business, not only from enlarged automotive schedules but from miscellaneous sources. With the exception

PACKARD POSTPONES PROGRAM

DETROIT—Packard is understood to have postponed the program for its new light six and in three months will reconsider whether to spend a proposed $5,000,000 on it. Meanwhile tool and die work for this new car has been withdrawn, leaving some of the local tool and die shops with far less business on hand than they had a few days ago. The plan for Packard plant rearrangement for 1940 output, however, will go ahead as originally scheduled.



"Superfinished" for Super-Service—*These pistons being loaded into a superfinishing machine at the Chrysler factory in Detroit will look much shinier when they come out on the other side. Machine produces a surface almost optically perfect, with scratches kept down to two millionths of an inch*

of Ford which has considerable steel mill capacity, it is said that the car manufacturers do not have exceptionally large stocks on hand or on order, and they see considerable tonnage from these companies alone. Another and perhaps more encouraging factor is that orders placed by firms in other lines are more numerous and call for more tonnage per order. February's tonnage was little changed from the preceding month despite fewer working days, and was about double the amount during February, 1938.

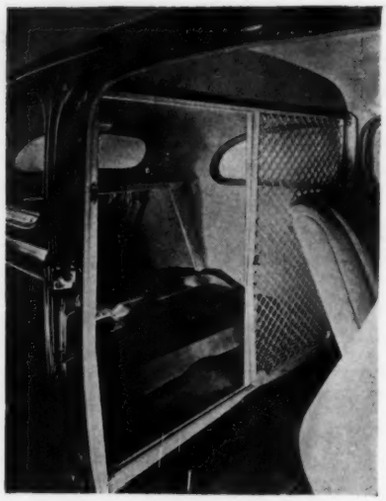
As stated previously, there seems little prospect of many mechanical changes in '40 cars. Machine tool interests have floods of inquiries on hand but most of these are for routine changes, such as new hole locations and retooling for slightly modified parts. As one man expressed it, "Our office has been turned into an engineering information department, but we seem to have lost the art of selling." Of course, a few machines are being sold, but far less than normal in proportion to the amount of work quoted on. Whether any good-sized economy programs will be assembled and released is still a matter of speculation. It seems to some that the automotive industry is finding itself with enough capacity on hand to get by with for a time, and is soft pedaling too many changes that might stir up labor.

DUTY EXEMPTIONS STIMULATE JAP MACHINE TOOL IMPORTS

TOKYO—Altogether sixteen machine tool manufacturers operating a total of eighteen plants have been licensed by the Department of Commerce and Industry in Tokyo to build machine tools under special privileges, such as tax exemption and duty-free importation of production tools. In return for these privileges, the manufacturers are obliged to abide by orders which the government may issue in respect to plant expansion, types of machine tools to be built and preference in the execution of orders.

This provision has already been invoked as manufacturers have been ordered to specialize in tool types allotted to them by the government.

It is believed that the principal purpose in imposing fixed production lines on the manufacturer is to get more firms to produce planers. Most manufacturers have become reluctant to build planing machines because their construction requires much material which is difficult to obtain and involves little processing, leaving only a small profit margin. The post-war depression that is expected to follow the present boom will also hit planer manufacturers more severely than makers of lathes and drills, it is believed.



Cagey—*A sliding gate in the steel mesh screen of this Plymouth "Utility Sedan," developed especially for salesmen, keeps bulky packages where they belong while allowing convenient access*

RUSSIAN TOOL DEMAND FIRM

NEW YORK—Soviet purchases of machine tools and other mechanical equipment in this country this year are expected to be about the same as in 1938, according to semi-official advices. Last year total buying in the United States amounted to about $60,000,000, of which around 30 per cent is estimated to have been machine tools.

SALESMEN EXPECT INCREASE IN MACHINE TOOL PURCHASES

CLEVELAND—Machine tool buying is definitely on the upturn, according to salesmen of the Warner & Swasey Co. who attended the organization's annual sales conference held in Cleveland Feb. 24–25. The meeting included salesmen from the company's 22 sales districts in the United States and Canada.

Salesmen from practically every sales territory said they anticipated an increase in orders during the coming month and that inquiries are now on the increase in almost every line of industrial activity.

LIVING COSTS DROP SLIGHTLY; CHIEF DECLINE IN FOOD PRICES

NEW YORK—The cost of living of wage earners in the United States declined 0.5 per cent from December to January, because of decreases in the cost of food, clothing and gas and electricity, according to the regular monthly survey made by the Statistical Division of the National Industrial Conference Board.

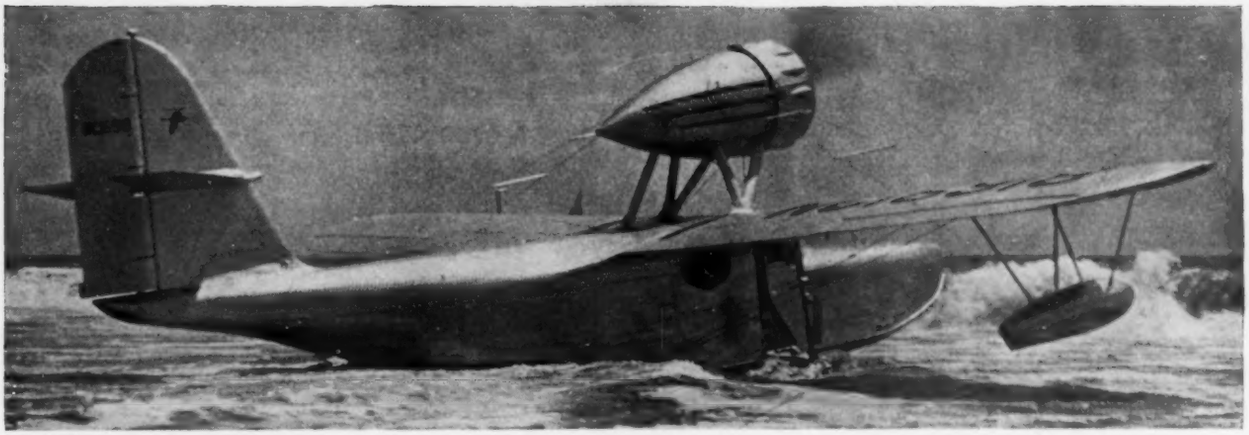
Living costs in January, 1939, were 2.4 per cent lower than in January, 1938, 14.4 per cent lower than in January, 1929, but 19.1 per cent higher than at the low point of 1933.

Food prices declined 1.4 per cent during the month, rent averaged the same, clothing prices were 0.4 per cent lower, while coal prices remained stationary.

U. S. Government Contracts Awarded to Metal-Working Firms

(Awarded from Feb. 6–18 inclusive)

Contractor	Gov't Agency	Commodity	Amount
Steel & Alloy Tank Co., Newark, N. J.	Commerce	Buoys	$31,064
McKay Co., Pittsburgh, Pa.	Commerce	Buoy chain	22,830
American Chain & Cable Co., Bridgeport, Conn.	Commerce	Buoy chain	18,749
Jeffrey Mfg. Co., Columbus, Ohio	Navy, S. & A.	Conveyor chains	18,023
Hardie-Tynes Mfg. Co., Birmingham, Ala.	Navy, S. & A.	Compressors	41,070
Caterpillar Tractor Co., Peoria, Ill.	Farm Security Admn; Interior	Tractors, engine assembly	82,326
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio	War, Ordnance	Broaching machines	58,216
Baldwin Southwark Corp., Eddystone, Pa.	Navy, S. & A.	Plate bending machine	58,900
Dayton-Dowd Co., Quincy, Ill.	W.P.A., Treas., Proc.	Pumps	38,595
Buffalo Pumps Inc., Buffalo, N. Y.	Navy, S. & A.	Pumps	305,400
Logan Co., Louisville, Ky.	War, C.W.S.	Conveyors	52,799
American Machine & Metals, Inc., New York, N. Y.	War, Ordnance	Centrifugals	173,400
Allis-Chalmers Mfg. Co., Milwaukee, Wis.	Interior	Generators	476,331
United Aircraft Corp., Hamilton Standard Propellers Div., E. Hartford, Conn.	War, Air Corps	Propeller assemblies	1,676,250
Colorado Fuel & Iron Corp., Denver, Colo.	Interior	Rail equipment	50,394
Graybar Electric Co., New York, N. Y.	Interior	Tubing, fittings	28,948
Caterpillar Tractor Co., Peoria, Ill.	Interior	Tractors	39,489
Stewart Warner Corp., Chicago, Ill.	Navy, S. & A.	Engine parts	23,946
Levene Motor Co., Philadelphia, Pa.	Navy, S. & A.	Engine parts	49,288
Brown & Sharpe Mfg. Co., Providence, R. I.	War, Ordnance	Milling machines	32,474
Dienelt & Eisenhardt, Inc., Philadelphia, Pa.	Navy, S. & A.	Pipe expanding machine	20,500
American Tool Works Co., Cincinnati, Ohio.	Navy, S. & A.	Lathes	16,316
Northwest Engineering Co., Chicago, Ill.	Interior	Excavators	43,245
Crane Co., Chicago, Ill.	Navy, S. & A.	Valves	30,526
Westinghouse Electric & Mfg. Co., Sharon, Pa.	T.V.A.	Transformers	206,922
Wright Aeronautical Corp., Paterson, N. J.	Treasury	Aircraft engines	36,880
Bendix Aviation Corp., Bendix Products Div., South Bend, Ind.	War, Air Corps	Wheel and brake assemblies	71,130



Stainless for Air and Sea—*With discussion in the aircraft industry turning to the feasibility of making planes of stainless steel, interest centers on this ship built and operated by Fleetwings, Inc., of Bristol, Pa. The Model F-501 amphibian, shown above taxiing into the Pacific surf, utilizes this high-tensile alloy exclusively in the hull construction, while wing spars and ribs are also welded stainless. Ship weighs 2,450 lb. and attains a speed of 150 m.p.h.*

SEE IMMEDIATE INCREASE IN EXPORTS TO SOUTH AMERICA

NEW YORK—Activity in exports of metal-working machinery will show an immediate marked increase, according to several authorities here. Principal gains are looked for in South America, while Far Eastern markets are expected to remain active for a considerable period.

Of particular interest are the prospects developing in many South American countries, where activity has been comparatively slow during recent months because of the unusually hot summer. One leading machine tool exporter, just returned from an extensive trip through South America, reports that many signs point to even greater trade with several of these countries during the coming year than was carried on during the record year of 1938. A large volume of business is pending, and it is expected that appropriations from several governments, due around the middle of March, will start the ball rolling with a number of good-sized orders.

FOREIGN AIRCRAFT BUYING STIMULATES PARTS BUSINESS

BURBANK, CALIF.—To speed production on an order of 250 planes for the British Royal Airforce and an additional 50 bombers for the Australian Airforce, Lockheed Aircraft Corp. awarded a contract for parts and accessories amounting to approximately $250,000 to Ryan Aircraft Co., San Diego. According to Robert E. Gross, Lockheed president, this is the second major contract awarded to the Ryan company in recent months, the previous one having been an order for approximately $100,000 to build exhaust manifolds for the Lockheed bombers being delivered to England.

MILLIONS FOR PLANE ENGINES

WASHINGTON—Wright Aeronautical Corp. has been awarded a contract by the War Department for airplane engines totaling over $4,000,000. This is the largest contract let by the War Department since World War days. Wright is reported purchasing a considerable number of new machine tools to modernize its manufacturing methods and to add to its capacity.

23 SHIPS UNDER CONSTRUCTION FOR U. S. MARITIME COMMISSION

WASHINGTON—Of 53 ships under contract in the Maritime Commissions current construction progress report, 23 keels have been laid down, all in 1938–39. The contracts are divided among Newport, Sun, Federal, Bethlehem, Tampa, and Moore Drydock of Oakland. Twelve tankers are for Standard Oil of New Jersey, one liner for U. S. Lines, four cargo boats for American Export, and three for Mississippi Shipping. All others are for government account.

Percentage of completion runs all the way from zero to 99.8, with many around 20, 30, 40. Only one, the Standard Oil tanker *Cimarron*, has been launched. By taking 1938 as its first full year of activity the Commission has made its 50-units-per-year quota of contracts let. The real test of the government's maritime policy will come next year, or next, when experience will show whether many ships can be placed with the debt-burdened foreign service, or whether the Commission will have to operate some of the lines, probably at losses even greater than the present subsidies.

INDUSTRIAL EXECUTIVES TO AIR VIEWS AT MARKETING MEETING

BLOOMFIELD, N. J.—Viewpoints of many prominent industrial officials concerning advertising and marketing programs will be revealed at a unique regional conference for industrial marketing and advertising men of New England, New York, New Jersey and Eastern Pennsylvania, to be held in Newark, N. J., March 15, under the auspices of the Industrial Marketers of New Jersey, a chapter of the National Industrial Advertisers Association.

The theme of the conference, "Mirrors of Marketing," keynotes the unusual features of the session—that its purpose is to get the opinions of industrial officials and department heads on how advertising and marketing programs should be used and prepared to be most effective in turning products into profits.

Industrial leaders who are scheduled to present their views before the group include: Charles P. Gulick, chairman National Oil Products Co., Harrison, N. J.; M. A. Moore, comptroller Hyatt Bearings Div., General Motors Corp., Harrison, N. J.; John Barr, purchasing agent Ingersoll-Rand Co., Phillipsburg, N. J.; Dr. Weissmann, chief engineer Okonite Co., Passaic, N. J.; Joseph Rosenthal, plant engineer United Pigment & Color Co., Newark, N. J. A sales executive, distributor, service manager and salesman will also speak at these sessions.

Special features of the day sessions include an address by C. S. Ching, director of public and industrial relations, United States Rubber Co., New York, N. Y.; and R. C. Maddox, managing director, New Jersey Council, Trenton, N. J. At the banquet, Merle Thorpe, publisher of *Nation's Business*, will speak on "The Plight of Enterprise."

WATCHING WASHINGTON

McGraw-Hill Washington Bureau
PAUL WOOTON, CHIEF

Proposed amendments to Wagner Act sidetracked to avoid controversy; labor conferences seen by some as trick to forestall changes in act

WASHINGTON—Hearings on the several batches of proposed amendments to the National Labor Relations Act are postponed indefinitely, by order of the Senate Education and Labor Committee. The reason is that bitter controversy which would be stirred up would obstruct the new peace negotiation between the C.I.O. and A.F.L. proposed by the President. Some labor men here think that Senator Wagner and the President initiated the peace move at this time, foreseeing that it could be used to stall the amendment drive. But others say that Mr. Roosevelt sincerely wants C.I.O.-A.F.L. peace, and all is on the up and up. Nobody believes that the heat for amendments will be turned off indefinitely. Most believe that peace is out of the question at this time.

Wage-Hour Law Complications

You will recall that the wage-hour law exempts employers from the 44-hour provision in cases where they have contracts with N.L.R.B.-recognized unions providing that employees be worked not more than 1000 hours in six months or 2000 hours in a year. Now Administrator Andrews adds to that law his ruling that employers who take advantage of this exemption must guarantee their workers "either a fixed annual wage, or continuous employment for 52 weeks, or employment for 2000 hours of the year." Neither the C.I.O. nor A.F.L. have entered such contracts. A.F.L. expresses doubt that many employers would contract on a 2000-hour basis. Apparently the law is confused in not making provision for 1000-hour contracts. Trade circles in Washington don't think much will come of this exemption at this time. If the Wagner Act is amended, chances are that this only link between the N.L.R.B. and the wage-hour law will be removed.

Establish Raw Material Reserve

Bills providing $75,000,000 to $100,000,000 during the next three years for purchase of a reserve of strategic raw materials are being favorably considered in Congress. The Munitions Board has listed seventeen essential but scarce materials. Assistant Secretary of War Louis Johnson mentions antimony, chromium, manganese, nickel, tin, mica, tungsten and others. Administration approval of this move has been expressed by Secretary of State Cordell Hull as conducive to non-involvement and neutrality. Johnson says he favors purchase abroad of such goods as cannot be produced at home. The bills provide for research looking toward domestic development of the needed materials.

Wide World

Secretary Hopkins' Des Moines speech shows plainly what everybody knew: that he is still the President's man. Therefore, it is not what Hopkins says or does that really counts, but what Mr. Roosevelt does. Nevertheless, business representatives in the Capital accept this Administration peace gesture in confidence that Mr. Hopkins and Mr. Roosevelt both mean it, and expect it to be followed by conciliatory deeds. Added to this wampum for business chiefs are the Supreme Court's ruling against sit-down strikes, the prospect of amendments to the Wagner Act after the C. I. O.-A. F. L. peace parley turns into a continued battle, and the Roosevelt-Morgenthau "promise" of no new taxes.

No Decorations for Guam

Rejection by the House of a $5,000,000 item for decorating a sand dune, as Senator Borah referred to Guam, was the amber caution light flashed before the Administration by the powerful isolationist group in Congress. It now appears that President Roosevelt took accurate measure of his opposition and asked for all the defense power and money he could have hoped to get. His War Department expansion and Navy air base authorization proposals, and the Army and Navy supporting appropriation bills, are all moving toward certain enactment.

Reveal Hand in Reorganization

Observers who surmised that the Navy, State and War Departments had a hand in reorganization of the U. S. Aeronautical Chamber of Commerce are confirmed as secret testimony of Grant Mason, member of the Civil Aeronautics Authority, is made public by the Senate Military Affairs Committee. Mr. Mason, who expected his evidence would be held confidential, says that C.A.A. and other government agencies always had trouble in getting cooperation and statistics on aircraft production, because the industry was never completely represented under one roof. It is now, under able Col. John H. Jouett. Expect to see the Chamber in the forefront of aviation affairs.

What Price Prosperity?

Business men trying to figure out the future may well be confused by the Washington picture, with the President, Morgenthau and Hopkins promising no more taxes "unless," and with Congress boosting budget appropriations right and left. One answer is clear. Congress will keep on spending, will spend more than the budget, will force the Treasury further into the red. But the Administration is desperately anxious for better business, will do almost anything in reason short of repudiating the New Deal social reforms in order to bring it about. It figures that only if business is better next year can the New Deal's achievements be retained.

The real difficulty lies in a divergence of view inside the Administration. Hopkins is pretty well sold on a reasonable attitude toward business. Morgenthau is convinced some step must be taken toward a balanced budget with a view to preventing fear of inflation. But Eccles has much following in his contention that only by big spending can the situation be made better, and that a greatly increased national debt is nothing to worry about.

RAILROAD BUYING INCREASES; SOUTHERN PACIFIC PROMINENT

CHICAGO—With railroads reporting January income gains, fair business in February and carloadings holding to a good level the railroad buying picture looks very encouraging. Buying still continues, Baldwin Locomotive Works having landed an order for 28 oil burning freight and passenger engines and Lima Locomotive Works an order for 12 coal burning freight and passenger engines from the Southern Pacific Railway for a total of $7,250,000.

The courts recently announced approval of the 1939 budget of the Milwaukee railroad. Included expenditures are 1,000 50-ton all steel box cars and 75 new style steel cabooses, all to be built in the company's own shop. About $3,700,000 worth of rails are to be purchased. Six diesel electric switching locomotives at a cost in excess of $40,000 are to be acquired under a lease-purchase plan.

The Union Pacific Railroad expects to order fifteen high-speed passenger locomotives and has ordered materials for construction of 2,000 cars in its Omaha shop. It has ordered under-frames for 1,500 cars from Mt. Vernon Car Mfg. Co. and Pacific Car & Foundry Co.

The Illinois Central is taking prices on 1,000 hopper cars, and the Santa Fe is asking for bids for parts for rebuilding 500 refrigerator cars in its own shop. Maine Central is said to be asking prices on 750 freight cars. Ford Motor Co. has ordered three 1,000 hp. diesel-electrics from General Electric.

Steam locomotive business was hard hit, there being 25 on order as compared to 110 on February 1, 1938. While electric and diesel locomotive orders jumped from 21 to 59, an increase of eighteen since the first of the year.

FOR HELPING PLANE MAKERS

WASHINGTON — Each airplane manufacturer must have definite assurance and commitments from the government so that he can expand his plant to the extent required for efficient quantity production, says Gen. Henry H. Arnold, Chief of the Air Corps, writing in *Army Ordnance*.

Manufacturers must be reimbursed for the cost of developing purely military designs. More than one unit of each prototype must be built, to assure against loss. Contracts should be allocated to manufacturers not now fully engaged, with emphasis placed on adaptability to quantity production. Gen. Arnold says the industry can meet the new building program without undue inflation, and that it could meet requirements if we went on a war footing.

HARVESTER TO SPEND $3,000,000 AT MILWAUKEE

MILWAUKEE — International Harvester Co. will expend approximately $3,000,000 in modernizing and rearranging its Milwaukee plant. Part of the renovation will include preparation for the manufacture of two new sizes of diesel engines which are to be added to the present engine line. The new engines are smaller than the unit now manufactured and are to be used in tractors.

The program includes complete revamping of the foundry to equipment for specialization in the manufacture of large castings.

E. J. Leiser, superintendent, indicated that the increase in employment in the manufacture of the new engines would more than offset the volume of employment effected by the necessary removal of the cream separator and milking machine manufacturing activities to other plants.

JAP MACHINE TOOL EXPORTS UP

TOKYO—Increasing competition from Japan in Asiatic markets is shown by the fact that exports of machine tools and machinery from Japan during 1938 aggregated over $40,000,000, representing an increase of over $12,000,000 over the preceding year.

Eighty per cent of the exports was accounted for by shipments to Kwantung, Manchukuo and the Japanese-controlled part of China.

Silent Subways Soon—*Twenty tons of aluminum were used in constructing the new light-weight, streamlined, air-conditioned subway train soon to be placed in service on the B.M.T. lines of the New York Rapid Transit Co., in New York City. Below, Frank Shepard (center) New York Transit consulting engineer, points out salient features of one of the car trucks in the shops of the Clark Equipment Co., Battle Creek, Mich., where the train was built. Left to right, behind Shepard, are R. J. Burrows, Clark Equipment vice-president; J. H. Connors, B. F. Goodrich Co. vice-president in charge of mechanical division; George J. Stanley, vice-president Aluminum Co. of America; Arthur B. Newhall, Goodrich executive vice-president, and S. K. Colby, vice-president Aluminum Co. Below at left, John J. Sinclair, New York Rapid Transit Co. equipment superintendent, operates the "Cineston," one-lever control mechanism which operates the train's motors and three sets of brakes*

FRED GROTTS

MALCOLM REED

SYDNEY DILLON

PERSONALS

FRED GROTTS, vice-president and works manager, Chicago Steel Foundry Co., Chicago, Ill., has been elected president and a director, Fort Pitt Steel Castings Co., McKeesport, Pa. He succeeds the late C. S. KOCH.

LEM ADAMS has been elected vice-president Oxweld Railroad Service Co., a unit of the Union Carbide and Carbon Corp., New York, N. Y.

ALBERT E. HACKETT, formerly with the Thomson-Gibb Co., has joined the Pregressive Welder Co., Detroit, Mich., in an executive capacity. Mr. Hackett has been active in the resistance welding field for the past 30 years.

World's Widest Clad—*Said to be the widest ever rolled, this 152 x 151-in. nickel clad plate produced by the Lukens Steel Co., Coatesville, Pa., will form part of a welded chemical vessel. The plate is ¾ in. thick and weighs 5,315 lb.*

MALCOLM W. REED has been appointed chief engineer Carnegie-Illinois Steel Corp., Pittsburgh, Pa. Mr. Reed, formerly vice-president in charge of operations for American Steel & Wire Co., succeeds SYDNEY DILLON, who has been transferred to the office of the chief engineer of the U. S. Steel Corp.

GRAHAM H. ANTHONY, president Veeder-Root, Inc., Hartford, Conn., has been elected a director of the Southern New England Telephone Co. Mr. Anthony is also a director of Colt's Patent Fire Arms Mfg. Co., the Holo-Krome Screw Corp., Billings & Spencer Co., the Connecticut Manufacturers Association and the National Association of Manufacturers. He has been president of Veeder-Root since 1932.

C. L. COSTELLO has been elected president, Stewart Iron Works Co., Covington, Ky. He succeeds ROBERT F. STEWART, who has been named chairman of the board.

FRANCIS R. COWLES, since 1932 associated with the International Business Machines Corp., New York, N. Y., has been promoted to the position of assistant director of sales promotion. WILLIAM G. HAMBLEY, who has been a member of the organization since 1931, has been promoted from manager of the general sales department in the New York office to assistant to the sales manager of the electric bookkeeping and accounting machine division.

J. EDWIN DOYLE, personnel supervisor of the West Lynn plant of the General Electric Co., Schenectady, N. Y., has been appointed a director of the reorganized Massachusetts Unemployment Compensation Board by GOVERNOR SALTONSTALL.

C. M. EASON has been elected president Industrial Clutch Co., Waukesha, Wis. JOHN J. PFEFFER was named secretary, and E. R. ESTBERG, treasurer.

RALPH E. FLANDERS, president Jones & Lamson Machine Co., Springfield, Vt., and president National Machine Tool Builders' Association, was guest speaker at the regular meeting of the Buffalo chapter, American Society of Tool Engineers.

LOUIS M. GREENE has been appointed assistant works manager of the Pathe Engineering & Tool Mfg. Corp., Long Island City, N. Y., manufacturer of special production machinery.

WILLIAM F. HOBBS, chairman Bridgeport Hardware Mfg. Corp., Bridgeport, Conn., died Feb. 11. He was 86 years of age.

CHARLES L. HUSTON, JR., NORMAN R. ENTREKIN, W. PERRY TYSON, JOHN E. MCCAULEY and SAMUEL L. SHOBER, JR., have been elected directors of the Lukens Steel Co., Coatesville, Pa.

FRANCIS JURASCHEK has been appointed manager of market research, Carnegie-Illinois Steel Corp., Pittsburgh, Pa. Mr. Juraschek, whose business career includes experience as market counsellor, advertising manager, and sales promotion manager for several companies, formerly was consulting editor of *Iron Age*.

HENRY S. BEAL

HENRY S. BEAL has become associated with the Heald Machine Co., Worcester, Mass., as general manager. Mr. Beal has been manager of the Jones & Lamson Machine Co., Springfield, Vt., and has also served the National Machine Tool Builders' Association as president. More recently he has been president of the Sullivan Machinery Corp., Chicago, Ill.

GUY N. HARCOURT was elected vice-president and director in charge of Buffalo Foundry's engineering department, while GEORGE A. ROWLAND was appointed sales manager with headquarters in Buffalo. Mr. Rowland succeeds CHARLES W. PEARSON, who was recently elected executive vice-president and general manager of the company.

GEORGE W. HAUCK, since 1913 associated with the Crane Co., Chicago, Ill., has been made manager of the engineering sales section of the valve and fitting department.

G. J. HAWKEY, president Cleveland Duplex Machinery Co., Cleveland, Ohio, has been elected chairman of

the Cleveland chapter, American Society of Tool Engineers. Also elected were: R. H. BEHREND, National Acme Co., vice-chairman; C. V. BRINER, Pratt & Whitney Co., secretary; and C. W. SCHEIHING, National Carbon Co., treasurer.

WILLIAM ABBETT LEWIS, JR., engineer with the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., has been appointed director of the School of Electrical Engineering in the College of Engineering, Cornell University.

JOHN W. LOHNES has been named assistant general sales manager, Vanadium Corp., of America, New York, N. Y.

FRANK L. NASON, Boston manager of the central station department of the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., has been appointed New England district manager. He succeeds the late JAMES P. ALEXANDER.

HOWARD E. OBERG, vice-president Billings & Spencer Co., Hartford, Conn., has been elected a director. He succeeds W. ROY MOORE, who previously resigned as vice-president and secretary.

Mr. Oberg began with the company 16 years ago and for eight years has had charge of commercial forging sales. He formerly operated his own tool and die plant at New Haven and was also associated with Winchester Repeating Arms Co., New Haven.

WILLIAM M. RECTOR, Weirton Steel Co. district sales manager in Rochester, N. Y., has been named district sales manager in New York City. His post in Rochester will be filled by W. E. SNELLGROVE, former assistant sales manager, New York District.

V. A. ROOT has joined the Rockford Machine Tool Co., Rockford, Ill., as sales manager. Mr. Root has been active in machine tool and army ordnance work for many years and most recently was located in the Cleveland office of William Stamets Co.

C. H. SAITER, Pittsburgh district manager, Cleveland Crane & Engineering Co., has been appointed heavy crane division sales manager, with headquarters at Wyckliffe, Ohio.

MARION A. SAVAGE, designing engineer, General Electric Co., Schenectady, N. Y., has been awarded the 1938 Lamme Medal of the American Institute of Electrical Engineers "for able and original work in the development and improvement of mechanical construction and the efficiency of large high speed turbine alternators." The medal and certificate will be presented at the annual summer convention of the Institute, to be held in San Francisco in June.

DONALD G. SHERWIN, vice-president Caterpillar Tractor Co., Peoria, Ill., has been elected a director. He succeeds C. PARKER HOLT, deceased.

H. N. ANDERSON

K. F. BRUCH

R. E. CHRISTIE

KARL F. BRUCH, son of F. W. BRUCH, founder of the Acme Machinery Co., Cleveland, Ohio, and for over 25 years associated with the organization, has been elected president. H. N. ANDERSON was elected vice-president and general manager, while E. P. BRUCH, another son, was elected secretary-treasurer.

R. E. CHRISTIE has been appointed assistant to R. E. Desvernine, president, Crucible Steel Co. of America, New York, N. Y.

J. T. WHITING

J. T. WHITING, former vice-president Alan Wood Steel Co., Conshohocken, Pa. has been elected president. He succeeds CLEMENT D. WOOD, who has resigned, but who will continue as chairman of the board. C. E. DAVIS, former assistant vice-president, has been named vice-president.

ROBERT C. STANLEY, president International Nickel Co., will be nominated to succeed WALTER S. GIFFORD as a director of the United States Steel Corp., according to EDWARD R. STETTINIUS, JR., chairman of the board. Mr. Gifford, who has been a U. S. Steel director since 1928, has indicated that in view of his other responsibilities it would be inadvisable for him to stand for election for another three-year term.

BUSINESS ITEMS

Bailey Meter Co., Ltd., Montreal, Canada, has opened branch offices in Toronto, under the managership of W. L. THOMPSON.

The Fawick Co., Wabash, Ind., has been organized to manufacture minor auto accessories in connection with the Wabash plant of the General Tire & Rubber Co. The new firm, capitalized at $100,000, will produce torque transmitting mechanisms, including clutches, fractional-ratio tire drives and brakes. Directors of the new concern include D. W. MAXON, S. C. ANDRESS, R. M. COBBS, and R. I. MOORE, all of Akron, Ohio.

Clark Controller Co., Cleveland, Ohio, has acquired control of the Invex Corp., Bethlehem, Pa., an electrical research organization. Invex is being moved to a new 61x37-ft. two-story brick addition at the Clark plant. Research on the standard line of Clark products will be continued by the previous personnel, and the Invex Corp. will work on new lines to supplement Clark's present regular manufacture. Invex is retaining its corporate identity and is headed by W. H. WILLIAMS, president, who is also vice-president and sales manager of Clark, and by PALMER H. CRAIG, who remains as vice-president of Invex.

International Standard Electric Corp., a subsidiary of International Telephone & Telegraph Corp., by means of a long-term contract with the Cincinnati Electrical Tool Co., will manufacture and sell, in foreign countries, a line of portable electric tools. The I.T. & T. subsidiary will also have available the technical advice and assistance of the Cincinnati company in manufacturing abroad other portable electric tools under its own trade marks.

Stearns Magnetic Mfg. Co., Milwaukee, Wis., maker of magnetic separators, clutches and brakes, has con-

cluded arrangements with the Exolon Co., Blasdell, N. Y., whereby the Stearns organization will manufacture and sell the Exolon line of magnetic separators.

Steiger & Kerr Stove & Foundry Co., Irvington, Calif., is planning to remodel and enlarge the recently purchased plant of the Reid Bros. Mfg. Co. The plant will represent an investment of over $600,000 when finished.

United American Metals Corp. has opened a new plant in San Francisco for the manufacture of babbitt metal, solder and bushing bronze. The new plant, supplementing other United American plants in Brooklyn, N. Y., Chicago, Ill., and Baltimore, Md., is equipped with specially constructed furnaces for alloying by the Stanley process.

Wheelco Instruments Co., Chicago, Ill., has appointed C. W. LUGAR as representative in the Indianapolis territory.

OBITUARIES

JOSEPH C. BELDEN, 63, president and chairman of the board, Belden Mfg. Co., Chicago, Ill., electrical wire and cable manufacturer, died Feb. 17 at his home in that city following an extended illness. Mr. Belden founded the company which bears his name in 1902.

COL. JOHN L. BUCHANAN, General Electric Co. executive, died at a hospital in Greenwich, Conn., Feb. 23. He was 55 years of age.

CHARLES R. CRANE, former president of the Crane Co., Chicago, Ill., died at his home in Palm Springs, Calif. He was 80 years old.

ABRAHAM R. GIFFORD, retired safety engineer of the Pittsfield (Mass.) Works of the General Electric Co., died at his home in that city Feb. 20. He was a native of Westport, Conn., and was formerly a machinist in the Taunton, Mass., Locomotive Works.

HERBERT A. JOHNSON

HERBERT A. JOHNSON, for many years U. S. representative of the Leipzig Trade Fair, Inc., New York, N. Y., and since 1937 president of the Board of Trade for German American Commerce, Inc., died Feb. 20 in a New York Hospital. He was 43 years of age.

Mr. Johnson, a native of America, received his education and early training in Germany. Following the war, he returned to the United States where he became affiliated with the United Knitwear Mills as vice-president. In 1927 he joined the staff of the Leipzig Trade Fair, Inc. He subsequently became active in the field of German-American trade, serving as a director and vice-president of the executive committee of the board of trade for German-American Commerce, Inc., being elected president of that organization in 1937.

A. M. CLARK, 67, president Columbia Steel Casting Co., Portland, Oregon, died Feb. 10 in San Francisco, Calif.

WALTER B. GRANT, president American Tube Works, Somerville, Mass. died recently at his home in that city.

JAMES H. GRAY, former assistant vice-president of the United States Steel Corp. and prominent in the introduction of the electric furnace into commercial steel mill production, died recently in Berkley, Calif.

DAVID E. JAMES, 50, vice-president and general manager of the Niagara Steel Finishing Co., Niagara Falls, N. Y. died recently in that city following a brief illness.

FRED A. KEY, 70, founder and vice-president Key Co., St. Louis, Mo., manufacturer of power plant and oil refinery equipment, died Feb. 25 following a heart attack.

FRANK P. JONES, 69, former general manager Dominion Iron & Steel Co., Montreal, Canada, and prominent in Canadian industrial circles, died Feb. 27 in Montreal, following a five-year illness.

WILLIAM D. SMITH, founder of the Ohio Machine Tool Co., Kenton, Ohio, died Feb. 17. He was 79 years of age.

MEETINGS

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual meeting, Hotel Cavalier, Virginia Beach, Va., May 15-17. J. C. MCQUISTON, secretary, 602 Shields Bldg., Wilkinsburg, Pa.

AMERICAN IRON AND STEEL INSTITUTE. General meeting, Hotel Waldorf-Astoria, New York, N. Y., May 25. Executive secretary, WALTER S. TOWER, 350 Fifth Ave., New York, N. Y.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. Annual meeting, Palmer House, Chicago, Ill., March 14-16. W. S. LACHER, secretary, 59 E. Van Buren St., Chicago, Ill.

AMERICAN SOCIETY OF TOOL ENGINEERS. Annual meeting and Machine & Tool Progress Exhibition, Convention Hall, Detroit, Mich., March 14-18. FORD R. LAMB, executive secretary, Room 428 Boulevard Temple Bldg., 2567 W. Grand Blvd., Detroit, Mich.

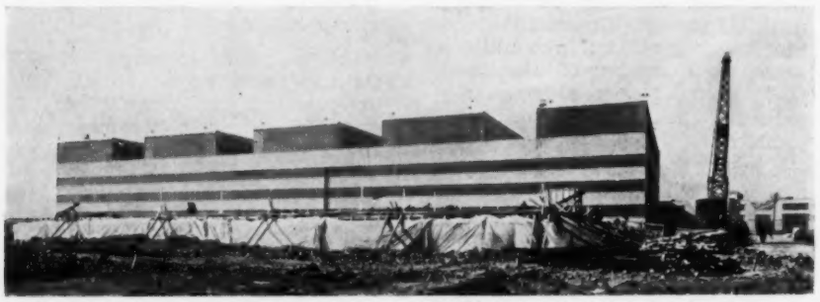
ASSOCIATION OF IRON AND STEEL ENGINEERS. Annual Spring conference, Hotel Tutwiler, Birmingham, Ala., March 27-28.

MACHINE TOOL ELECTRIFICATION FORUM. Annual meeting, East Pittsburgh, Pa., April 18-20. Director, R. S. KERSH, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MIDWEST POWER CONFERENCE. Annual conference, Palmer House Hotel, Chicago, Ill., April 5-7. Director, DR. L. E. GRINTER, Armour Institute, Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS. National aeronautic meeting, Washington, D. C., March 16-17.

World automotive engineering congress, Hotel Pennsylvania, New York, N. Y., May 22-28; Hotel Statler, Detroit, Mich., May 31-June 8; Hotel Fairmont, San Francisco, Calif., June 6-8.



Fast Work—*Two weeks after construction was started on a new factory for the Glenn L. Martin Co. aircraft plant at Middle River, Md. The new structure, 694 x 340 ft., will nearly double the company's manufacturing space, and along with $900,000 worth of machine tools and other equipment, comprises the major unit of the concern's $2,750,000 expansion program*

SHOP EQUIPMENT NEWS

Thread Grinder Provides Automatic Truing

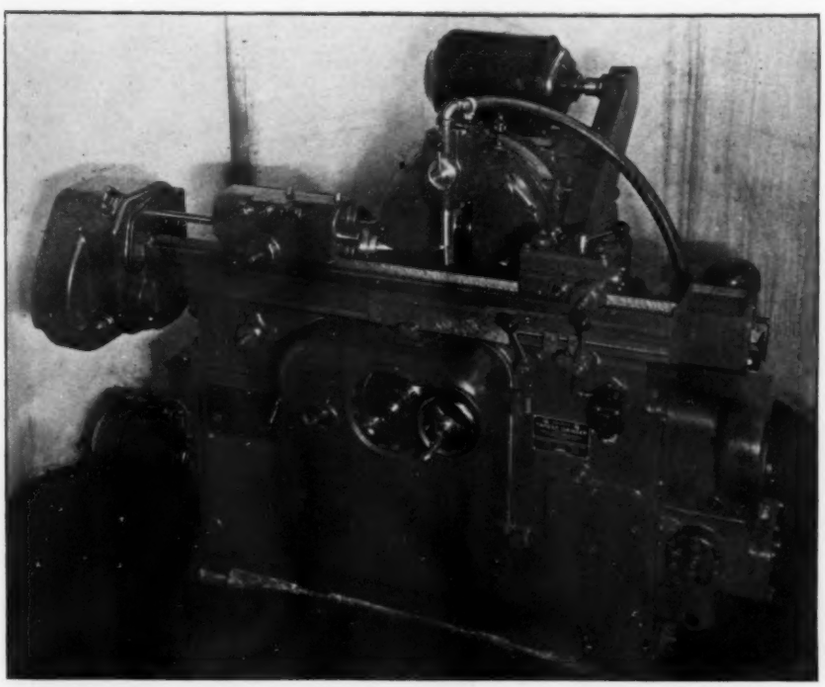
The 5 x 30 in. automatic thread grinder announced by the Jones & Lamson Machine Co., Springfield, Vt., will grind threads of every type up to 5 in. diameter and 12 in. long anywhere on work 24 in. in length. This machine swings work 7 in. in diameter and accommodates 30 in. between centers. Like the 8 x 48 in. thread grinders made by this company, the 5 x 30 in. machine has been designed around the automatic wheel truing device as the primary element. Accuracy of thread angle is guaranteed within ± 5 min. on the half angle, lead to ± 0.0002 in. per in. with a cumulative error not to exceed 0.001 in 12 in. On production work the machine will grind threads automatically to a pitch diameter tolerance of 0.0005 in.

The grinding wheel spindle and its driving motor are mounted on a cradle to permit tilting the wheel to correspond with the helix angle of the thread to be ground. The wheelhead unit operates on roller bearings which ride between hardened and ground rails. Provision is made on the work spindle to compensate for backlash when grinding in both directions. Speed changes for the work spindle are made through sliding gears on multiple-spline shafts mounted on ball bearings. Positive forward and reverse speeds are provided for two-way grinding any thread within the rated capacity of the machine.

Adjustment is provided for grinding slight tapers by means of a graduated screw. Tapers of more than a few thousandths, which naturally affect the lead, are obtained by inserting hardened and ground formers which directly control the action of the wheel slide and make it unnecessary to compensate for either lead or form on the grinding wheel. With suitable formers, the machine will grind combinations of taper, straight and taper, or double taper threads. It also is possible to apply formers for automatically feeding the wheel in and out of cuts, as is sometimes required when grinding a worm thread on a shaft where the outside diameter of the worm and the unthreaded portions of the shafts are of the same diameter.

The machine is equipped to feed in the grinding wheel automatically until correct size is reached, at which point the feed is stopped automatically. The wheel also is advanced automatically to compensate for decrease in its size after truing. The operator determines at what point of the machine cycle the truing should be done. He also determines the amount that should be dressed off the wheel to maintain the proper form. After the machine has once been adjusted, these functions are automatic for succeeding work.

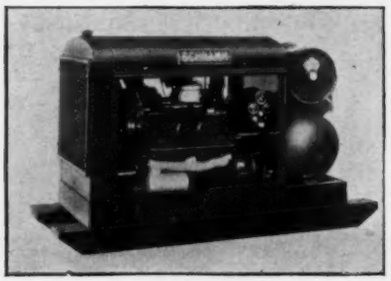
The standard machine will grind single, double, triple, quadruple and sextuple threads, and includes pitch change gears for all pitches from 2 to 48 inclusive. The machine will grind right-hand threads having helix angles up to 25 deg. and left-hand threads up to 30 deg. Standard attachments are available for grinding relief on taps and hobs; grinding annular grooves without lead and for ternal thread grinding. Four independent rapid traverse speeds are provided for the wheelhead.



"Fordair" Compressors Are Self-Contained

The Model 55 "Fordair" compressor announced by Schramm, Inc., West Chester, Pa., is an adaption of a single Ford V-8 block which converts four of the cylinders to air cylinders, the remaining four cylinders furnishing engine power. Each outfit is a complete, self-contained air plant with automatic unloading pilot valve and engine slow-down. Equipment includes electric self-starting, a radiator cooling system, air and fuel tanks and a control panel with all gages conveniently located. Air delivery at 100 lb. per sq. in. pressure is 55 cu. ft. per min. These units can be mounted on skids, as shown, or on two-wheel trailers.

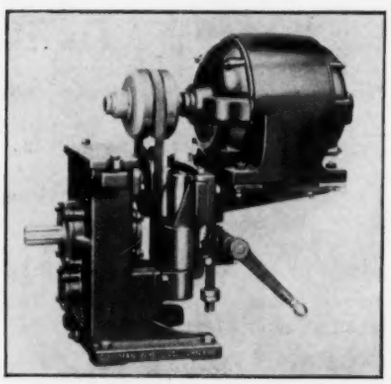
The Model 105 "Fordair" compressors consist of a V-8 block con-



verted to an air compressor and powered by a standard Ford engine of the same design as the compressor end. These units deliver 105 cu. ft. per min., at 100 lb. per sq. in., and are available in two-wheel trailer, motor-truck mounting and skid mounted models.

Variable Speed Pulley Developed for Reducers

Developed particularly for use with Cullman speed reducers, the variable speed V-pulley offered by Cullman Wheel Co., Inc., 1344 Altgeld St., Chicago, Ill., is suitable for motors

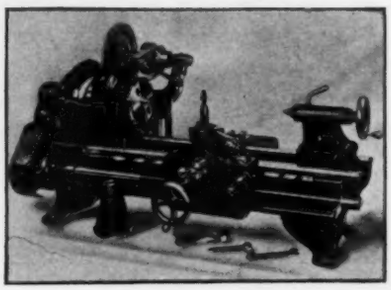


ranging from ¼ to 3 hp. The ratio of speed is up to 2.6 to 1. Raising the motor will decrease the speed of the driven unit while lowering the motor increases the speed. Crank-operated bevel gears are provided for raising and lowering the motor.

"Sheldon" Bench Lathe Has 10⅛ In. Swing

The "Metal Worker" precision screw-cutting bench lathe announced by Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Ill., has a 10⅛ in. swing and a center distance of 20 or 26 in. with bed lengths of 38 or 44 in. respectively. A complete line of attachments is available for use with this lathe.

Headstock spindle has a $1\frac{1}{16}$ in. diameter hole through its entire length and is equipped with a ball thrust bearing. Spindle bearings are line bored and lapped to fit. A com-

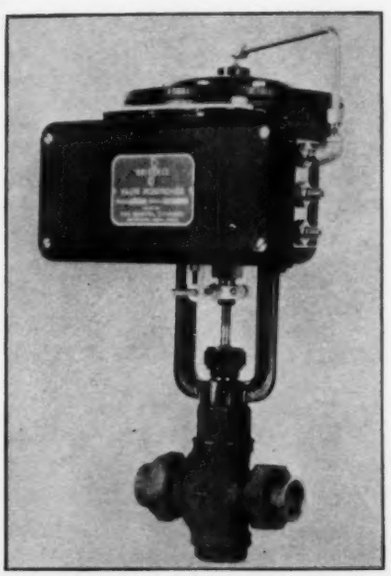


plete set of gears is furnished for cutting threads ranging from 4 to 112 per in.; these gears are hob cut from steel.

The carriage is provided with an automatic power longitudinal feed with change gears to provide feeds ranging from 0.002 to 0.015 in. Cross feed is hand-operated. Feed and lead screw reverse is provided by a reverse lever on the headstock. The cross slide carries a swivel slide graduated 90 deg. on each side of center. Net weight of the 38-in. bed unit without drive is 315 lb.

Valve Positioner Offered For Control Valves

The Bristol Co., S. Main St., Waterbury, Conn., has announced development of a pneumatic valve positioner for use on diaphragm control valves to overcome the effect of friction in

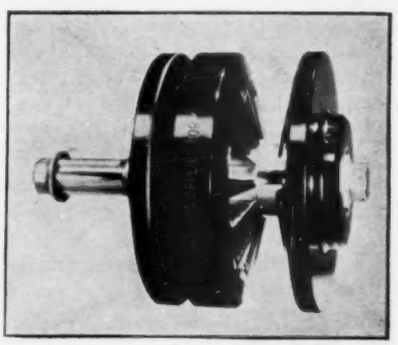


the valve stem and top. This device is recommended for use on all air-operated control installations where close control is of paramount importance, particularly where there is considerable process lag. This positioner assures a proportionate valve stem travel for even the slightest change in the pressure of the air from the controller.

"Speedmaster" Pulleys Available in Two Sizes

Continental Machine Specialties, Inc., 1301 Washington Ave., S., Minneapolis, Minn., have announced an improved design of "Speedmaster" pulleys. These infinitely variable speed pulleys are molded of solid high-impact strength Bakelite and are balanced before final assembly. A pressure lubricated bronze sleeve allows the splined center sheave member to operate freely regardless of load or speed.

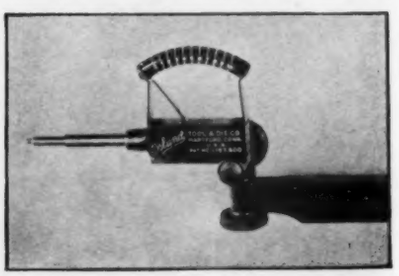
The pulleys are available in two sizes; a 3½ in. diameter size for drives up to ½ hp. capacity, and a 6½ in. diameter size for drives up to 3 hp.



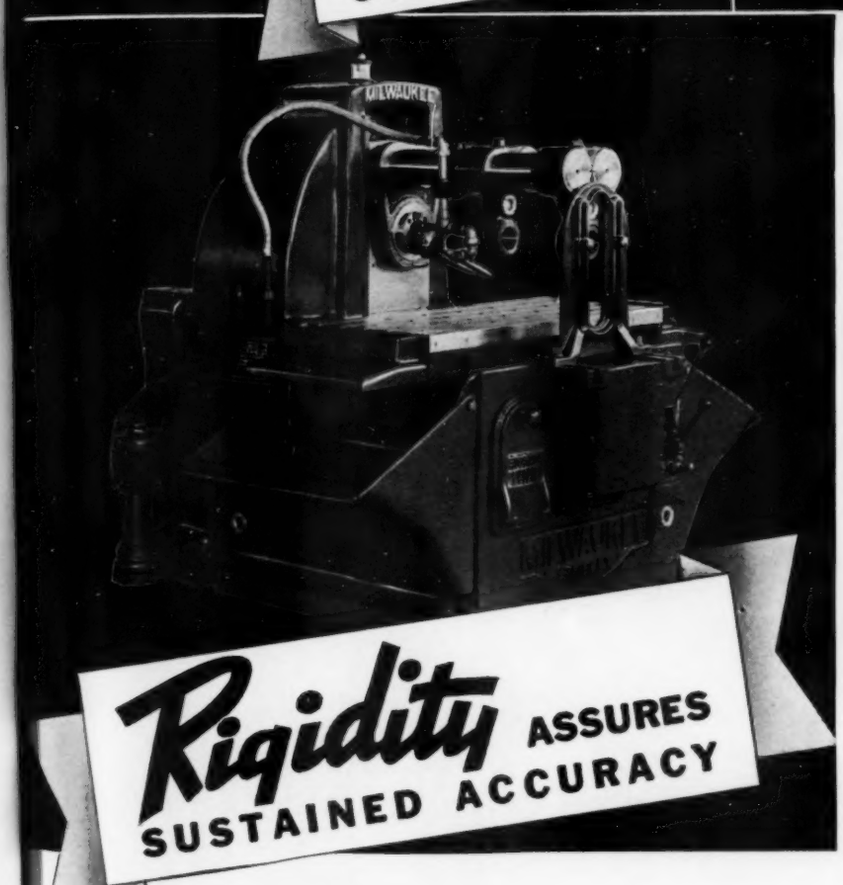
capacity. Interposed between the motor and the driven unit, the position of the pulley can be changed to vary the center distances in relation to the driving and driven sheaves. Standard V-belts are used.

Universal Indicator Can Be Read Easily

The scale of the universal indicator made by the Oslund Tool & Die Co., 14 Sigourney St., Hartford, Conn., is designed to make it readable in any position. Readings can be made without the use of mirrors when the indicator is upside down or facing



GREATER *Range* 7 INCHES
CROSS ADJUSTMENT, SUPPORTED OVER ENTIRE RANGE



Rigidity ASSURES SUSTAINED ACCURACY

1200 AND 1800 SERIES

. . . . BED TYPE, SIMPLEX AND DUPLEX MILWAUKEE MILLING MACHINES

Anchored quill construction is one of the outstanding advantages of Milwaukee Simplex and Duplex, Bed Type, Milling Machines — provides 7 inches cross adjustment, resulting in greater range without sacrifice of rigidity. Every unit designed for strength, compactness and sustained accuracy under heavy continuous service. » »

KEARNEY & TRECKER CORPORATION
WEST ALLIS STATION MILWAUKEE, WIS., U .S. A.

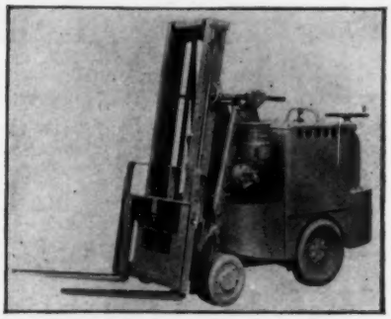
MORE THAN *40 years* OF DOING ONE THING WELL

K&T *Milwaukee* MILLING MACHINES

towards the back of the machine. When used with the fulcrum attachment the indicator is held in a parallel position and still has body clearance so that there is no need for tilting the indicator or turning a contact point and so affect the scale reading. The mechanism is shock proof and it is claimed that the indicator will not be damaged should the contact point accidentally be pushed beyond the total travel of the pointer. Attachments permit the use of this indicator in tool posts, jig borer spindles and on surface gages.

New Fork-Type Truck Has Eight Speeds

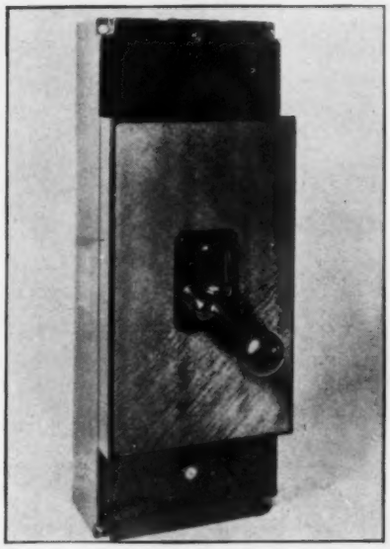
Made with rated capacities up to 5,000 lb. and with four speeds forward and four reverse, the Type F-11 hand-wheel steered telescoping fork truck offered by Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleve-



land, Ohio, is equipped with a 500 per cent overload, heavy-duty and high-torque motor. The power circuit is closed and broken by a mill-type magnetic contactor which is electrically interlocked with the controller. This truck has two-wheel rear drive and four-wheel steer. The three-point power plant design is such as to permit the truck to travel over uneven floors without transmitting strains to the mechanism.

"De-Ion" Breakers Protect Main Feeders

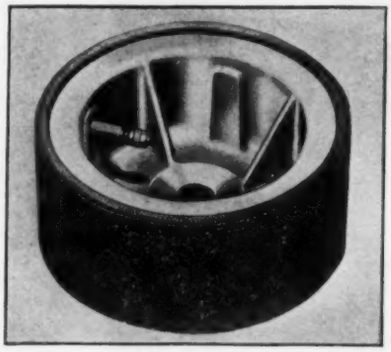
Type AB-20 "De-Ion" air circuit breakers, designed for circuit protection of main distribution feeders in industrial plants where concentrations of power make necessary a breaker of 20,000-amp. interrupting capacity, have been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These breakers are available in ratings of from 70 to 600 amp., and for voltages up to and including 600 volts on a.c. or 250 volts on d.c. Silver-alloy con-



tacts are claimed to assure positive contact and long life with maximum protection against "welding" on heavy short circuits.

"Mall" Sanding Drum Has Improved Band

The Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill., has announced development of an improved pneumatic sanding drum which can be used on all types of flexible shaft grinders. A smooth polished surface is said to be obtained because of the soft air cushion which holds the abrasive in place. This drum has a hub over



which is fitted a clincher-type inner tube. A rubberized fabric band is placed over this tube and suitable abrasives of different grits are placed on the outside of the fabric sleeve, being held in place by inflation of the air tube.

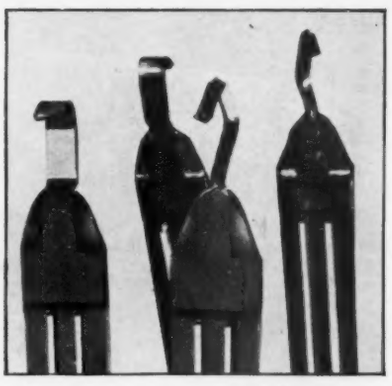
A. C. Brake Incorporates Special Torque Motor

Smooth, quiet, efficient operation on alternating current is claimed for the torque motor operated brake announced by Cutler-Hammer, Inc., 205 N. 12th St., Milwaukee, Wis. This brake is designed especially for those applications where positive, quick cushioned braking is required for stopping or holding a load. The torque motor, operating through an anti-friction ball jack, releases the

brake. When the circuit is opened a heavy helical torque spring sets the brake and flywheel action of the rotor provides smooth braking. This brake is available in five sizes, providing maximum torque ratings of 160 to 3,200 lb. ft. on intermittent duty.

"Multi-Edge" Anodes For Chrome Plating

A double "Multi-Edge" anode with rectangular ribs on both sides has been announced by the Republic Lead Equipment Co., 7932 Jones Road, Cleveland, Ohio. This anode is offered for plating from both sides when used as a center anode in the chromium plating tank. It is a progressive development of the single "Multi-Edge" anode, with ribs on one side only, which is used on side anode rods and was first introduced in 1936.

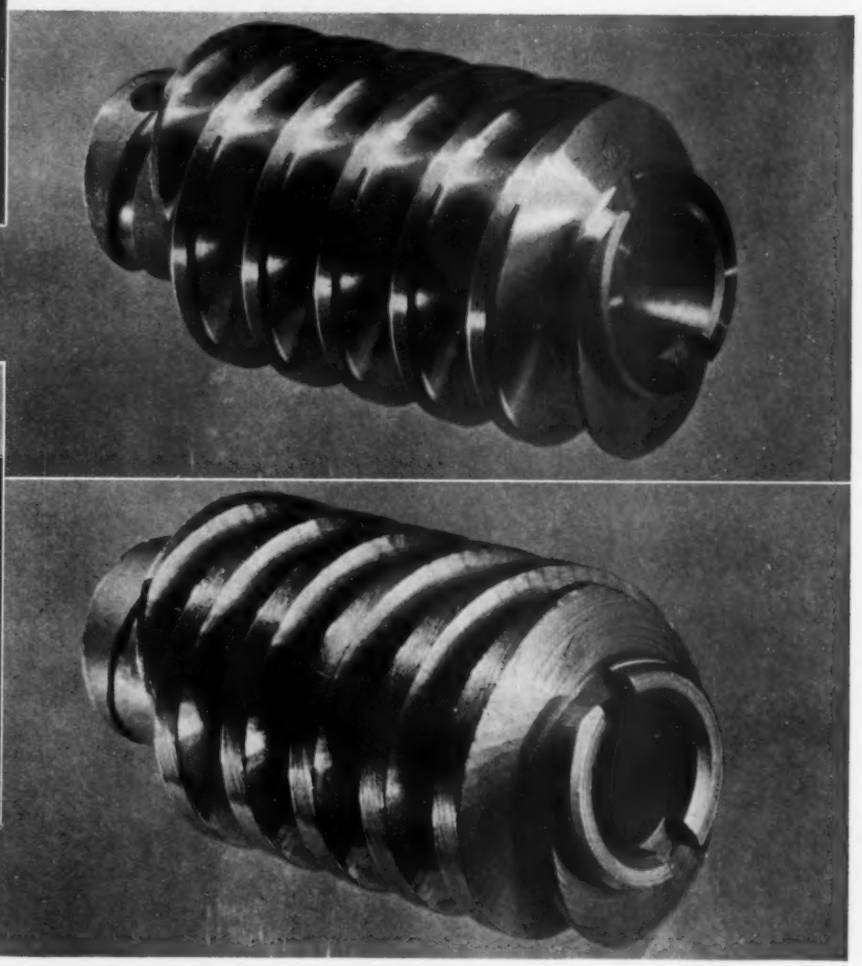


Hooks on both types are made to suit the user's requirements, with either a flat or knife edge. These hooks can be made to fit round, rectangular, or square rods.

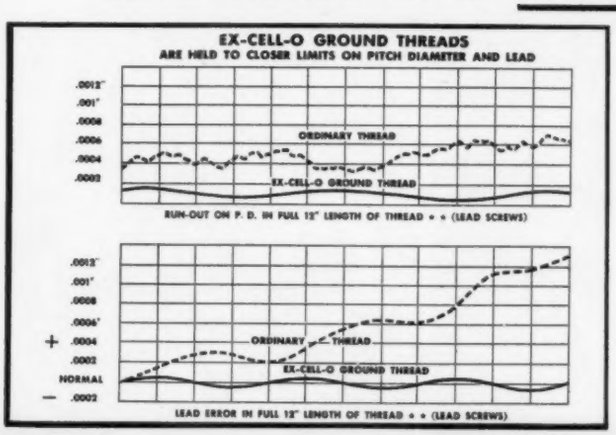
Ex-Cell-O thread that has been milled, hardened, sand-blasted and Precision Ground.

Ordinary thread that has been milled, hardened, sand-blasted and polished.

. . . Now you can reduce wear, improve performance with EX-CELL-O PRECISION GROUND Threaded Parts . . .



SAVE MONEY WITH EX-CELL-O PRECISION PARTS . .



You can improve your product and save money by using Ex-Cell-O Hardened and Precision Ground Threaded parts, because no other method produces such extreme accuracy of thread form and size at the same low cost. In addition to the advantages of *hardened* steel (Ex-Cell-O grinds threads *after hardening,* to correct heat treat distortion), you get enduring accuracy and smooth finish. Perfect interchangeability eliminates expensive selective assembly. Full bearing contact with mating parts evenly distributes the load; it reduces noise, friction and wear, and increases strength, rigidity and efficiency, of positioning, holding and power transmission parts.

Send us blueprints of your parts for a quotation and learn how you can improve the efficiency of your product with Ex-Cell-O Precision Ground Threaded Parts.

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★ EX-CELL-O *Precision* MACHINES *for* CENTER LAPPING • TURNING • TOOL GRINDING • BORING • FACING REAMING • DRILLING • THREAD GRINDING • COUNTERBORING
AND TOOLS *for* SURFACE GRINDING • COUNTERBORING • FACING • MILLING • TURNING BROACHING • FORMING • BORING • INTERNAL GRINDING • REAMING ★

TRADE PUBLICATIONS

APPROVED EQUIPMENT The December, 1938, list published by the Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Ill., comprises a list of inspected gas, oil and miscellaneous appliances.

BALANCING MACHINES Bulletin No. 14, published by the Tinius Olsen Testing Machine Co., 500 N. Twelfth St., Philadelphia, Pa., contains 24 pages describing and illustrating the Type EO vibro-electric static-dynamic balancing machines.

BALANCING MACHINE The Type S static-dynamic balancing machine is described in a booklet released by the Tinius Olsen Testing Machine Co., 500 N. Twelfth St., Phila., Pa.

BALL BEARINGS A series of bulletins discussing important features of ball bearing design and construction has been issued by the Marlin-Rockwell Corp., Jamestown, N. Y. Bulletin No. 20 discusses general types of ball bearing mountings, while No. 21 deals with duplex bearing mountings. Bulletin No. 22 tells how to adjust the preload of duplex bearings, and No. 24 provides limits for shaft and housing fits. Typical mountings of snap-ring ball bearings are shown in Bulletin No. 24, while No. 25 provides 12 pages of design features, dimensions and recommendations concerning these snap rings.

CHASER GRINDERS Bulletin No. A-87-1, now being distributed by the Landis Machine Co., Waynesboro, Pa., provides specifications of a line of chaser grinders and chaser grinding fixtures.

DIE FEEDS H. E. Dickerman Mfg. Co. 286 Wilbraham Ave., Springfield, Mass., describes and illustrates die feed features in Bulletin No. 86.

DUST CONTROL A folder released by the Pangborn Corp., Hagerstown, Md., illustrates various industrial applications of dust collector units.

ELECTRONIC CONTROL "Marvels of the Electric Eye" released by the United Cinephone Corp., 43-37 33rd St., Long Island City, N. Y., discusses numerous industrial applications of photoelectric cells.

FLOORING A folder issued by the Flexrock Co., 23rd & Manning Sts., Philadelphia, Pa., describes "Ruggedwear" floor resurfacing materials.

GAS FURNACE American Gas Furnace Co., Elizabeth, N. J., describes the No. 29-F machine for continuous heat treating in Bulletin No. 801.

HACKSAW BLADES "Hacksaw-ology," a 24-page illustrated booklet published by the Simonds Saw & Steel Co., Fitchburg, Mass., provides specifications of various types of hacksaw blades and includes hints on their care and use.

HAND LIFT TRUCKS The Yale & Towne Mfg. Co., Philadelphia Div., Philadelphia, Pa., has published a 16-page pamphlet describing an extensive line of hand lift trucks and skid platform equipment.

HAND TOOL The "Handee" line of hand grinders and accessories is described in a 64-page illustrated catalog issued by the Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago, Ill.

HAND TRUCKS A pamphlet released by the Yale & Towne Mfg. Co., Philadelphia, Pa., illustrates the features of several types of hand lift trucks and skid platforms.

HOIST The Yale & Towne Mfg. Co., Philadelphia, Pa. has issued a

Smile the smile of satisfaction with fast cutting, clean threading Wyckoff in the chuck, the cold drawn bar stock that makes possible higher spindle speeds at no sacrifice in quality or accuracy—the steel that assures more pieces per hour—more hours per grind.

WYCKOFF DRAWN STEEL COMPANY
FIRST NATIONAL BANK BUILDING, PITTSBURGH, PENNA. — 3200 SO. KEDZIE AVENUE, CHICAGO, ILL.
Mills at Ambridge, Pa. and Chicago, Ill. . . . Warehouse Stocks in Principal Cities
Manufacturers of Carbon and Alloy Steels . . . Leaded Steels . . . Turned and Polished Shafting . . . Turned and Ground Shafting . . . Wide Flats up to 12" x 2"

leaflet illustrating the "Pul-Lift" chain hoist.

HOISTING EQUIPMENT A 20-page illustrated pamphlet published by the Yale & Towne Mfg. Co., Philadelphia Div., Philadelphia, Pa., provides specifications of an extensive line of power and hand-operated chain hoists.

HYDRAULIC CYLINDERS The Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill., describes its Series "N" double acting hydraulic cylinders in Bulletin No. 35-A.

LATHE ATTACHMENTS South Bend Lathe Works, 279 E. Madison St., South Bend, Ind., provides specifications of a line of chucks, tools and other lathe accessories in its 12-page illustrated Bulletin No. 77.

LATHES Catalog No. 97, published by the South Bend Lathe Works, 279 E. Madison St., South Bend, Ind., contains 72 pages describing and illustrating the features of an extensive line of lathes. Also included are discussions of the "Junior" and "Workshop" lathes, along with specifications concerning many chucks, tools and other lathe attachments and accessories.

"MEEHANITE" Booklet No. 100, offered by the Meehanite Research Institute, 423 Fourth Ave., Pittsburgh, Pa., describes and illustrates various adaptations of "Meehanite" to pumps faced with severe service requirements. Copies may be obtained through the Meehanite Metal Corp., Vandergrift Building, Pittsburgh, Pa.

METAL HOSE Catalog No. G-14, published by the Chicago Metal Hose Corp., Maywood, Ill., contains 38 pages describing and illustrating the "Rex-Weld" and "Rextube" flexible metal hose, along with "Avioflex" fuel line tubing.

MOTOR APPLICATIONS A motor application chart, Bulletin No. 515, issued by the Louis Allis Co., Milwaukee, Wis., lists 26 types of motors, checks these types for about 50 standard applications, and analyzes their various mechanical and electrical characteristics.

MOTOR STARTER "De-Ion" nonreversing linestarters with built-in control-circuit transformers and designed for applications where a low voltage control circuit is desired are described in price list No. 11-200, released by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTOR STARTERS A folder issued by the Allen-Bradley Co., 1326 S. First St., Milwaukee, Wis., describes a line of solenoid starters for industrial electric motor application.

MOTORS An 8-page illustrated bulletin, No. 1195, released by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., illustrates features of a line of "Lo-Maintenance" squirrel cage induction motors.

MOTORS Manual No. 21-121, issued by the Century Electric Co., 1806 Pine St., St. Louis, Mo., discusses the installation, care and adjustment of fractional horsepower, single phase capacitor motors.

PLASTIC TESTING MACHINES Bulletin No. 17, published by the Tinius Olsen Testing Machine Co., 500 N. Twelfth St., Philadelphia, Pa., describes and illustrates a line of machines for conducting various tests on modern plastics.

PORTABLE TOOLS The Van Dorn Electric Tool Co., 716 Joppa Rd., Towson, Md., is distributing copies of its 56-page illustrated 1939 catalog, describing the "Red-Head" line of portable electric tools and accessories.

PRECISION GRINDERS The 1939 Catalog published by the Precision Grinder Div., Dumore Co., Dept. 139a, Racine, Wis., contains 28

TODAY!
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Stuart's
Cutting, Grinding
Deep Drawing
OIL PRODUCTS
SAVE MONEY FOR USERS!
Products that are original and different plus modern sales engineering total a service worthy of investigation by every economy-minded plant executive.
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pages of illustrations and data concerning a line of precision grinders and accessories.

PRECISION LATHES South Bend Lathe Works, 279 E. Madison St., South Bend, Ind., provides specifications of the Series R 13-in. swing precision lathe in Bulletin No. 13-D.

SHIPPING AIDS A 48-page illustrated catalog entitled "Shipper's Handy Helper," published by the Diagraph-Bradley Stencil Machine Corp., 3745 Forest Park Blvd., St. Louis, Mo., contains information concerning packaging, crating and shipping problems.

SILENT CHAIN A 48-page illustrated engineering data book, No. 1645, published by the Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., discusses features of the "Silverstreak" silent and roller chains.

SPEED SELECTOR An automatic power-operated device for three types of turret lathe spindle speed changing is described in an illustrated folder, Form 1074, offered by the Gisholt Machine Co., 1201 E. Washington Ave., Madison, Wis.

STEEL SECTIONS The December, 1938, Steel Products Manual, published by the American Iron & Steel Institute, 350 Fifth Ave., New York, N. Y., comprises Section 4 of a discussion of rolled steel structural sections. Copies may be obtained from the Institute for 15 cents each.

STEEL SELECTION Copies of a "Machinery Steel Selector," for determining the proper steel for given machinery applications, are being distributed by the Horace T. Potts Co., Philadelphia, Pa.; Brown-Wales Co., Boston, Mass.; Beals, McCarthy & Rogers, Buffalo, N. Y.; and Equitable Equipment Co., New Orleans, La.

STIFFNESS TESTERS Tinius Olsen Testing Machine Co., 500 N. Twelfth St., Philadelphia, Pa., describes a line of stiffness testers in Bulletin No. 11.

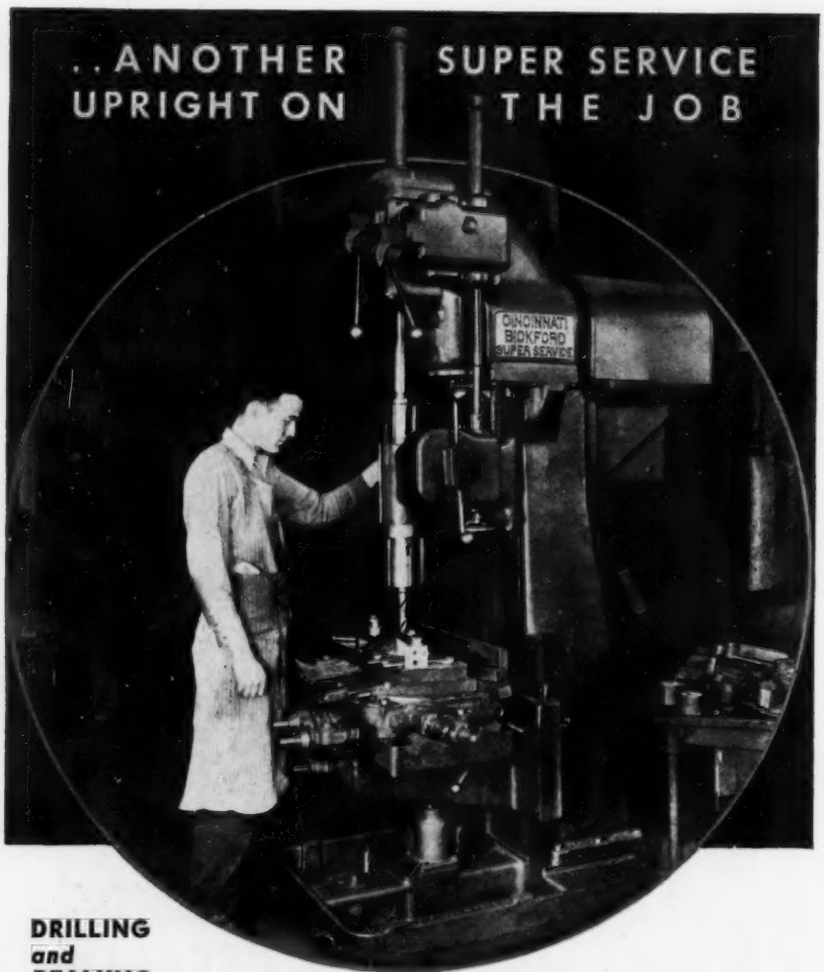
TESTING MACHINES The Tinius Olsen Testing Machine Co., 500 N. Twelfth St., Philadelphia, Pa., includes specifications of a line of ductility testing machines for sheet metal and wire in its 16-page illustrated Bulletin No. 15.

TIN PLATING The International Tin Research and Development Council, Fraser Road, Greenford, Middlesex, England, has made available Booklet No. 82, entitled "Electrodeposition of Tin from Alkaline Solutions."

TRUCKS A leaflet issued by the Yale & Towne Mfg. Co., Philadelphia, Pa., illustrates many types of electric industrial trucks and tractors.

TRUCKS Elwell-Parker Electric Co., Cleveland, Ohio, has issued two pamphlets describing a line of power industrial trucks. Bulletin No. A-8416 illustrates Type EP-10 low-lift platform trucks, and Bulletin No. A-8459 covers Type ELN-10 high-lift platform truck.

VARIABLE TRANSMISSION A folder now being distributed by B. F. Perkins & Son, Inc., Holyoke, Mass., describes features of the "Variducer" variable-speed gear transmission.



DRILLING *and* REAMING ARE EASILY, ACCURATELY HANDLED

The Pneumatic Scale Corporation, Norfolk Downs, Mass., modernized drilling operations by installing a modern 28" Super Service upright drill with compound table.

The job shown here consists of drilling and reaming 1" holes in a 4"x4"x2" bearing. Accuracy is held to ±.004".

This user reports the Super Service so easy to handle that it it is a time and money saver on even one and two piece lots. You, too, can depend on "More Holes per Dollar" when you take advantage of the adaptability, productivity, accuracy and ease of handling offered in Super Service Uprights. Available in 21", 24" and 28" All Geared Sizes. *Write for Bulletin U-22.*

SUPER C.B SERVICE

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.

NEW BOOKS

ELECTRICAL YEAR BOOK, 1939—*Thirty-second year of publication. 377 pages, 4 x 6⅛ in. Indexed and illustrated. Clothboard binding. Published by Emmott & Company, Ltd., 31 King St. West, Manchester, 3, England. Price 1/6 net.*

The section on alternating current systems has been rewritten for this edition in order to provide more concise definitions and to introduce addi-

tional practical information. Some new data on exciters has been added to the section on turbo-alternators and on single-phase induction motors in the section on induction motors. The subject of meter accuracy and testing has been rewritten and a note on approved types has been added. The section on electrical measuring instruments has been revised to include treatment of the rectifier type of instrument and new information is included in the discussion of instrument transformers.

The following are the main divisions in this book: Insulative and magnetic materials; a.c. systems; calculations; condensers; power consumption of appliances; international symbols; power plant operation; d.c. generators; turbo-alternators; a.c. and d.c. motors; power to drive machinery; dynamo and motor defects; transformers and converting plant; transmission and distribution; control gear; electric traction; rectifiers; accumulators; lighting; wiring; lighting circuits and switches; meters and instruments; testing; earth resistance; welding and cutting; mathematical tables which include a table of logarithms.

SEEN and HEARD

JOHN R. GODFREY

25 Millionths

When centerless grinding was an experiment and three-cornered work was by no means a rarity, we little dreamed of the perfection that would some day be attained by this method. Some of the early work was done by Rob Grant, son of John J., in his little shop in Detroit. The first commercial work I recall was shackle pins for auto spring connections, which were not taken as seriously then as now.

In contrast with this I recently saw some plungers used in diesel engine injection valves that were beautiful examples of centerless work. The maximum tolerance in diameter is 25 millionths of an inch, which translates into a "quarter-tenth." And they have to be round enough to hold 5,000-lb. pressure with a leakage of not over six to eight drops per minute. To anyone who likes really fine work, this is a joy to behold.

Pick-Me-Ups in the Shop

Many factories find that it pays to let the men get a sort of a pick-me-up during the working period. Hence the automatic vending machines have found a place in many shops, both large and small, so that a chocolate bar, or other bracers, is always available.

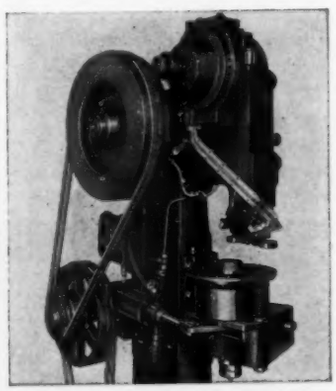
The latest is a portable food conveyor that can be wheeled down the aisles and supply hot or cold snacks right at the working station. Our unknown and unseen friend, electricity, supplies both heat and cold to the different compartments. Scientific check-ups are said to prove that the efficiency curve goes up when extra food is available. Stimulation caused by having visitors watch the workers sometimes works out the same way. Then again, it has been known to have the opposite effect!

Hogging with a Broach

Broaching "ain't what it used to be." Originially designed to nibble away at round holes to make them square or hexagon, or to finish oval or irregular holes, broaches have jumped to another class of work—and hogging cuts at that. Taking off $\frac{1}{16}$ in. of metal at each stroke of the ram might almost be called tangent milling.

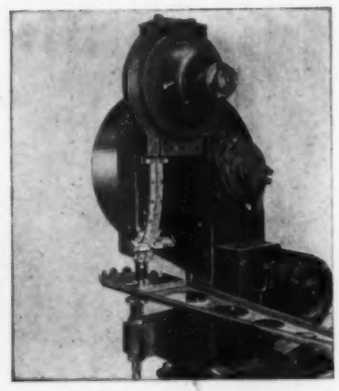
the RIVITOR
already serves these industries

AUTOMOTIVE . . .



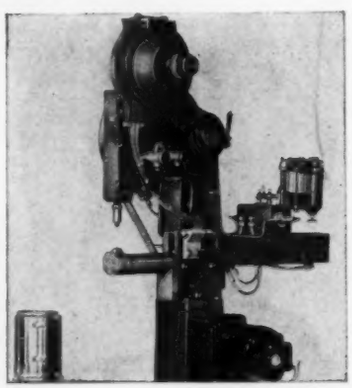
The Rivitor is shown here setting two solid rivets at a time to attach cushion springs to driven clutch plate assemblies.

AIRCRAFT . . . . . .



This is the standard "BR" Bench Type Rivitor tooled for setting 1/8" diameter x 1/4" long duralumin rivets in airplane sections.

UTENSIL . . . . . .



The Rivitor is shown here setting aluminum rivets to attach handle brackets to bodies of percolators.

CONTAINER . . . .

This Rivitor sets two rivets at the same time to attach handle brackets to paint pails.

The Rivitor ably handles not only these jobs in these industries, but many jobs in these and other industries, wherever there are solid rivets to be automatically fed and set to obtain a stronger joint—better—faster. Send for our new Bulletin R-1A. This will give you more information on the Rivitor in these industries.

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615 N. Mechanic Street Jackson, Michigan
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50-ft. Holes in a Hurry

SKIN tension in long bars plays an important part in the straightness of these bars when the bar is turned to diameter. If the strains from rolling are too unequal the turned bar may be too crooked to be satisfactory for oil-well drill stems or rods, which must be drilled their whole length. As some of these rods are 50 ft. long and have holes 3½ in. in diameter, this becomes quite a problem.

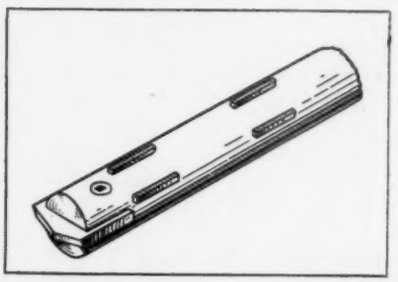
In turning these long bars it is customary in the oil country shops, to support the outer end in a chain sling instead of holding it rigidly in a steadyrest. This chain sling is free to move with the bar, both with the bars revolutions and with any side movement, or spring, that it may develop as the outer skin is removed. The amount of this out-of-roundness is checked by the indicator seen beside the bar.

This indicator is supported on a tripod beside the bar, so placed that the small wheel shown rides against the bar as it turns. This wheel is on the short end of a multiplying lever on the other side of the metal sheet. The upper end of the lever shows in the curved slot opening at the top so that it can be watched from either side. The upper arc above the slot is graduated to make it easy to check the movement. Any movement or "travel" in the bar out of the circular path of rotation. When this exceeds an amount that experience has set as the limit, the bar is considered unfit for use as a drill rod or stem.

A large indicator shows any distortion caused by removal of stock

After turning, these bars are drilled with a 3½-in. hole, the whole length of 50 ft. This drilling is done with a plain, two-lip cutter in the end of a bar that is about 3 in. in diameter. The cutter is held by a hollow-head setscrew. Behind the cutting edge are two sets of bearing guides, four in each set, built up by welding Stellite or other hard metal on the cutter bar itself. These guides are then ground concentric with the bar and support it in the hole.

The bar is relieved behind the cutter to permit the chips to work their way back aided by oil or cooling solution pumped in at about 30 lb. pressure. The efficiency of this boring bar is indicated by the speed with which these holes are bored—41 in. per hour. Boring is done in a machine improvised for the purpose. It has a hollow spindle and the bar being bored is held in a roller slide rest.



Drilling is done by a bar carrying a two-lipped cutter followed by eight bearing guides

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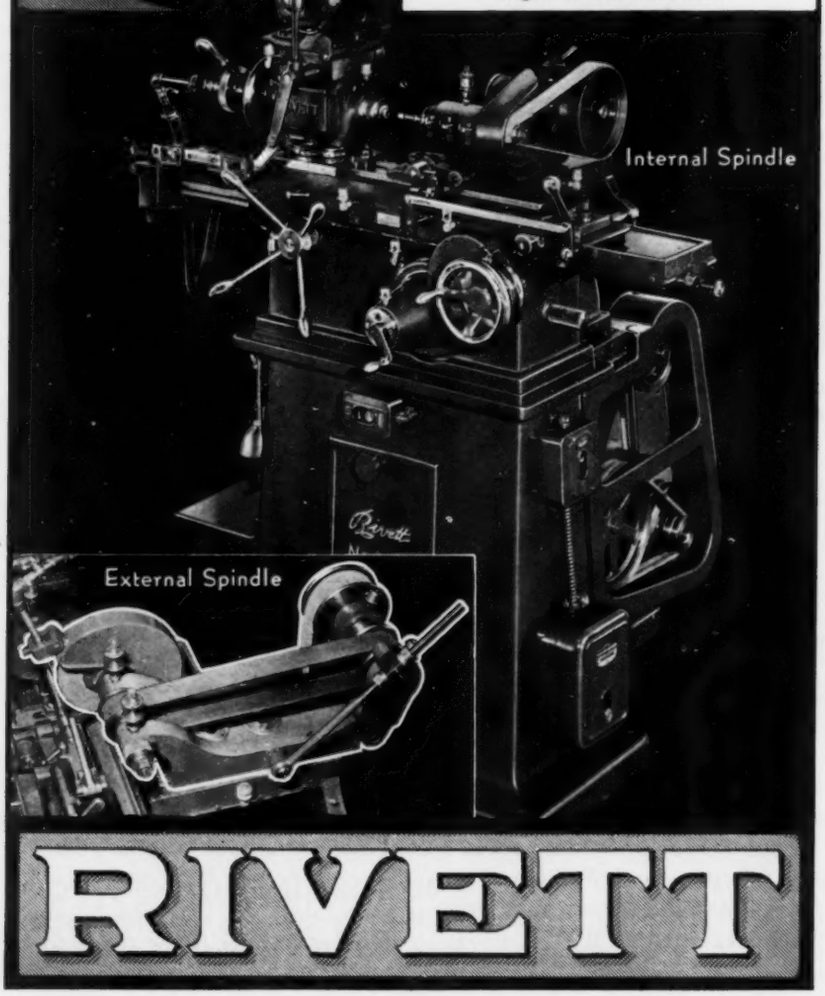

RIVETT

Management's Selling Job

J. E. BULLARD

Regardless of how much we may dislike to admit it, the facts are that, ever since the stock market collapse in the fall of 1929, there has been evident a public hostility toward management. It may not have grown so much in force, but it has become more articulate through the election of public officers who reflect the hostility of their constituents. At no other time in the history of the nation, however, would this condition have been as ominous as it is at the present time.

Much of the hostility is due to distrust, a distrust which has grown as the size of business concerns have grown, and the gap between management has become greater and greater. This distrust was fanned by the revelations of the practices of some financiers brought out by the investigations which took place shortly after the debacle in October, 1929.

It was not this, however, which caused the hostility in the first place. I spent my early youth on a New England farm. There, everybody was expected to do as much work as he could. Before the days of the mowing machine a farmer would start out with his scythe in the morning. He would cut a swarth. One hired man would follow him. Perhaps, there would be three or four men in all. The first man had to keep ahead of the one behind him, the second the one behind him and so on. Each tried to catch the one ahead. It was truly surprising how much hay those men would mow in a day.

Slow Down in Self Defense

Perhaps, I was too much embued with this spirit when I first went to work in a machine shop. At any rate, I took it for granted that I was expected to do as much work as I could and acted accordingly. But not for long. One of the oldest men in the department pointed out the error of my ways. If I did as much work as I could it would be bad for the others. Should it be piece work and I earned more than a certain amount, the piece rates would be changed and some men in the shop would not be able to earn a living. Should it be hour-rate work and I turned out much more than the average, future wage rates would probably be based on my production.

It just did not seem sensible, at first. However, in the course of a year or so, it had been made rather obvious to me it would be better to go with the crowd. Also, one could see there was reason in the attitude taken. The management did not want any man to earn more than a certain more or less indefinite maximum. There were a good many men in that shop who could have earned more than they did. They forebore from doing so because they felt changes would be made which would reduce their earnings and make it difficult, if not impossible, for some of the others to make a living.

In a great many shops, I have found the efficiency expert is looked upon with distrust. Every effort to reduce the cost of production by increasing the output per man is resisted. Perhaps it is being resisted more, today, than it ever has been in the past. This is caused in part by the fear that increase in output per man will mean fewer men working. Of greater importance than this, however, seems to be the suspicion that the management is endeavoring to keep down the earnings of the wage earner while increasing the returns to the stockholders and raising the salaries of the managing executives.

Yet, it is not all difficult, as a rule, to sell the idea of more production to labor. It has been done by exceptional companies in practically every

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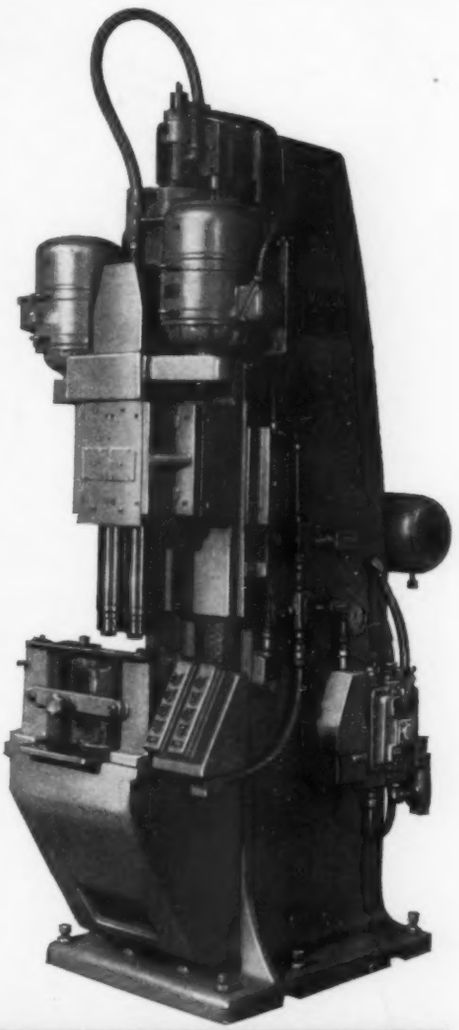
These advantages grow out of fluid power of course; but the number and degree of them are a function of the Oilgear design, construction and principle of operation alone. To make *your* machine more salable and more profitable, get in touch with Oilgear engineers or write for literature. THE OILGEAR COMPANY, 1309 W. Bruce St., Milwaukee, Wisconsin.



OILGEAR

FLUID POWER FEEDS

industry. It is partly a matter of winning the confidence of labor. This has been done through committees of wage earners who meet regularly with the president of the company. It has been done by showing by means of facts and figures, that each increase in production per man increases the buying power of the wage earner whether there is more money in his pay envelope or not. It is primarily a selling job.

A young man went into a shop to make time studies. He was instructed to stand at one machine but to time the man at another machine. He objected and asked permission to go at it his own way promising to obtain accurate results.

It was not difficult to see that the man he timed during the first morning was soldiering. At noon, he got his lunch and ate it with the men. He talked about the kick he used to get when he took a dinner pail to the plant where his father worked. He sold these men the idea he was really one of them. He won their confidence and then explained that if they worked with him, so he could get a fair result from his time study, it would be better for them and for him. He succeeded in selling this idea so well he had no more difficulty in that shop. Not only that, but the men were satisfied with the piecework rates based on the time studies this young man made.

It has become only too obvious that most of the trouble between labor and management, a large part of the public hostility which has been directed against management during the past eight or nine years springs from that fact that labor and management have drifted too far apart. Neither understands the problems of the other; each suspects and distrusts the other. It is largely a problem of getting together and getting acquainted.

If asked to symbolize "precision", the layman might well sketch a Micrometer. But to the skilled mechanic there is also another symbol: the Lufkin trade-mark, which for years has been associated by men in industry with precision tools of the finest quality.

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Anchoring Babbitt Linings

C. G. WILLIAMS

How many of us have, in the past, had the entire babbitt linings slip off the brass after peening that started cracks in the anchoring lugs? How many of us have had the brasses crack or check after machining the anchoring grooves when heating the brass to tin?

While spraying steel or bronze makes the metal in the laid-on portion harder than the original wire, spraying with babbitt, that is railroad babbitt, gives a softer composition than in the block, and the resulting sprayed-on layers, porous and excellent for light service, will crush and become matted in heavy service, destroying their oil-carrying ability.

It is also known that sprayed-on steel makes an excellent bearing, so much so that when used to repair truck gear-box shafts, they give more than 100 per cent service over and above the original bearing. This is because the sprayed-on material is porous, will absorb oil as will a sponge, and by giving up that oil as needed, will prolong the life of the bearing as a whole.

Co-ordinates for the Jig Borer—*Correction*

Errors in the Reference Book Sheet entitled "Co-ordinates for the Jig Borer" recently published (*AM*—Vol. 82, page 1097) have been called to our attention by R. A. Miner. Dimension *B* in Fig. 4 should be 0.33922; dimension *B* in Fig. 5 should be 0.14644; dimension *L* in Fig. 7 should be 0.29620; dimension *C* in Fig. 8 should be 0.18164; and dimension *N* in Fig. 9 should be 0.21292.